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MECHANIX ILLUSTRATED

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SPECIAL FEATURES

On the Cover: First kodachrome photograph released by the U. S. Navy of the new Grumman "Hellcat" (F6F), the Navy's speediest, most maneuverable fighter plane. For details see page 71. Kodachrome by Rudy Arnold.

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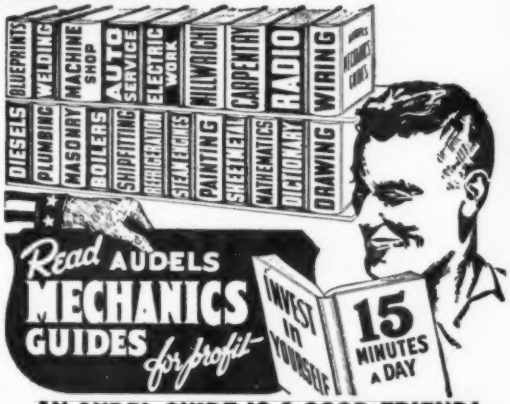

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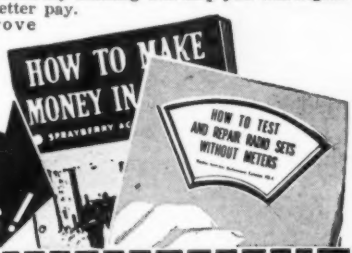

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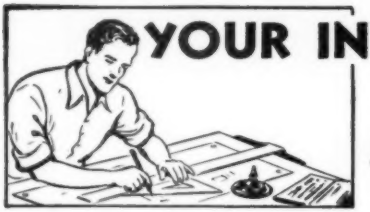

YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

Diesel-Operated Submarine

George Gerenda, Whiting, Indiana, wants to work upon a plan for operating submarine Diesel engines below the water's surface. He states that there are two things he would have to figure out; namely, how to get air to the intake of the carburetor and what to do about the exhaust. He wants an opinion as to whether or not this generalization is worth investigating.

ANSWER: *The general plan is not new. It is stated that the newer German submarines operate below the surface on their Diesels only. The air is said to be obtained from compressed air storage bottles. The exhaust is chemically treated and the remaining oxygen is used.*

It has also been suggested that Diesel engines be operated below the surface on a mixture of hydrogen and oxygen. On explosion, these gases are converted into water. New hydrogen and oxygen is stored in cylinders while the submarine operates on the surface. Ordinary sea water is electrically dissociated to produce the gases in proper proportions for ideal explosion.

Unquestionably, the greatest invention in this field would be the production of some sort of artificial lung which could remove air directly from the water in sufficient quantities and without too great a production cost. The fishes do it, but man has not yet been successful. This then is a scheme upon which you and other inventors can work. Someone will solve the problem.

Airplane Tail Assembly

Alfred Kaufmann, Jr., Newark, N. J., has submitted a design for a new style of airplane tail assembly on which he wants a comment.

ANSWER: *We do not recall having seen any tail assembly resembling the one you have designed. We believe that it may hold some advantages, but these can only be determined after extensive experimental tests.*

In accordance with our policy not to disclose an idea which we consider worthy of further development, we are omitting details of your proposal.

We are inclined to believe that in a diving operation, your tail assembly would extend too far under the slip stream to operate effectively. In the climbing position the opposite result would be obtained. In either position much greater stresses are placed upon the whole tail assembly.

Our recommendation would be that you build up a reasonably large size working model and test this in a wind tunnel even if you have to build the wind tunnel yourself. Before undertaking this part of the program we would recommend that you have a patent search made.

Market Analysis—Hydraulic Drive

W. J. You, Portland, Ore., asks some questions about inventions in general. These are made clear in the replies.

ANSWER: *A good invention does not require a market analysis. If it is good, its market is assured. On the other hand, there is no sense to inventing purely for the purpose of accumulating a lot of worthless patents. You should determine first if there is a need for the article you plan to design. If it does something which is required in a quicker, better, more efficient manner, or if it performs a task mechanically which must now be performed manually, the need automatically exists.*

Personally, I believe that a variable speed hydraulic drive is very desirable on motor cars. By this means full torque could be delivered to the rear or all four wheels of a car even at a speed of only one revolution per hour.

I consider the fluid drive an advantage. Whether or not it will be used on all cars depends largely on the manufacturers and also on the inventors who may be able to produce a unit better than the one currently popular. Perhaps an electrical drive will be the answer.

The combination torque converter and variable speed control mentioned in your communication may well solve some problems. Also, it may be too complicated. There probably are more simple methods for effecting the conversion. The operation of the steam engine would seem to point the path in this direction.

Lock Washer

Capt. J. C. Backe, Medical Corps, U. S. Army,

[Continued on page 155]

INVENTORS

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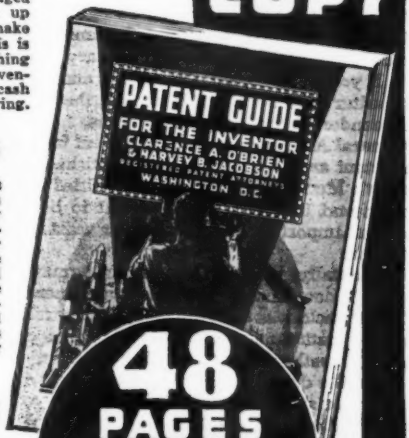
Now, more than ever before, is the right time to patent your invention. Why? Because manufacturers everywhere presently engaged in war production are looking ahead to the future by buying up patent rights now, so they will have new and attractive items to make and sell for civilian consumption as soon as the war is over. This is what happened during and after the last war. Hence, the smart thing for you to do is to look ahead to the future too. Protect your invention by applying for a patent now, so you will be in position to cash in on an outright sale, or on the royalties your invention will bring.



Patent Guide Shows What To Do

Our "Patent Guide for the Inventor" answers many important questions concerning Patents that inventors constantly ask. It tells what facts, details, drawings, sketches, etc. are necessary to apply for a Patent; how to protect your invention through dated and witnessed disclosure; how to do this AT ONCE to safeguard your rights; how Patent Office Records can be checked to determine whether the invention is probably patentable before filing fees need be paid; discusses costs involved and a practical way these can be paid as the application progresses. It tells how some inventors secured financial backing; how many simple inventions have proved large commercial successes; how Patents covering improvements also can be profitably utilized and marketed; tells countless other facts of interest.

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CHIPS FROM THE EDITOR'S WORKBENCH

General Arnold Says:

"IN THE near future . . . bombers will dwarf our present Flying Fortresses. They will carry half a carload of bombs across the Atlantic and fly home without stop. The plane will have 'eyes' that will guide it to its target. Fighter planes will have advanced almost beyond recognition."

Does that sound like some dreamer of Jules Verne dreams writing? Some visionary or crackpot? If you think so, you are greatly mistaken; for the writer is General H. H. Arnold, the four-star commander of the Army Air Forces.

General Arnold wrote that statement in a vitally important article which will be published in next month's MECHANIX ILLUSTRATED, entitled "Wings, Bombs and Bullets." We believe it to be one of the most important articles thus far written about this war.

Incidentally, we on MECHANIX ILLUSTRATED like to recall, now that he is a four-star general, that "Hap" Arnold was once a fairly regular writer for our publication and was also at one time carried on our masthead as an advisory editor. Those were in the days that he was a major and our air force was a struggling little affair. Since that time, General Arnold, more than any other one man, has been instrumental in bringing the American Air Forces to their present state of commanding might.

For as thrilling, informative and important an article as you have seen on the subject of American air power, be sure to read General Arnold's article, "Wings, Bombs and Bullets," in the January MECHANIX ILLUSTRATED.

Plus Added Attractions

I FILMED OUR ALEUTIAN VICTORY by Lt. Virgil Ellsworth, U. S. Signal Corps—a thrilling story by the service cameraman who photographed the important motion picture Report on the Aleutians, now showing in theaters throughout the nation. This article is a "must" for all camera fans, as well as a sparkling action story.

IN JANUARY, the Crafts and Hobbies Section of your favorite magazine is coming up with a scoop for you model airplane fans—a real coaxial prop for your gas models. This type prop, as you doubtless know, was developed in Italy and since then has seen action on some of the better Jap Zeros. Our engineering laboratories are busy delving into its mysteries at the present time. It features two propellers turning in opposite directions about a single shaft. Our how-to-build model is simple, light and very easy to construct, and will keep your gas job right up-to-date with the modern trends in aviation.

STREAMLINED SCIENCE MACHINE by Bernard Wolfe. You will find the amazing story of Dr. George Speri Sperti on page 50 of this issue. Dr. Sperti, although he has received little publicity, is one of America's great geniuses. We know when you have read the personality story about him in this issue, you will want to know more about his work. Next month Mr. Wolfe will take you behind the scenes in Dr. Sperti's laboratory to show you the works.

A TOY MACHINE GUN, capable of extreme rapid-fire, will be a feature next month the kiddies will go for in a big way. It's made of wood, is perfectly harmless, and all our Junior Commando has to do is load the magazine and turn the handle to fire the wooden tracers and bullets at an imaginary Jap or German who dares to invade his playroom.

YOUR POSTWAR JOB IN AVIATION by John Barnes. Many of today's combat fliers are planning on going into commercial aviation after the war. Mr. Barnes, an airline officer, discusses the difficulties these men will have to face if they expect to go into such work and tells how different their present flying is from commercial flying.

For a Merry Christmas

IN CASE you haven't already thought of it, you can solve a part of your Christmas shopping problem very handily this year by sending gift subscriptions of MECHANIX ILLUSTRATED to your friends. A gift subscription is not expensive—only $1.50—and it's a present that will keep your friends remembering you all year long.

Due to the paper shortage and transportation difficulties, it is often hard to buy a copy of MI on the newsstands. But if you give your friend a gift subscription, he will get his copy of the magazine regularly—and on time.

On page 144 you will find a handy coupon for ordering a gift subscription. Send it along and we will send your friends a Christmas card bearing your name and informing him of your present.

While you're about it, why not make yourself a present of a subscription?

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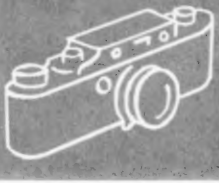
SECRET EYE OF THE UNDERGROUND



by Joseph Wechsberg

OCTOBER, 1940, was a critical month for France. French morale had reached an all-time low. With the blitz raging at its height, everything seemed lost. Weary, apathetic Frenchmen were willing to do business with the German invaders. Collaborationist Paris newspapers went all out for the New Order. No mention was made of Nazi atrocities in France.

Unless something was done to arouse the people, the spirit of resistance would vanish, completely. On October 27th the French Underground got a secret message that five French hostages, men and women, would be executed at six a. m. in the prison yard of Rennes. Here was a chance! A member of the Underground was ordered to get into the prison and make a photograph of the execution.

The place was closely surrounded by German soldiers. The only way to get through was by putting on a German uniform. Disguised as a *Feldgrauer*, the Frenchman reached the prison yard and joined a group of soldiers who thought the execution was some fun. He had a sickly feeling in the pit of his stomach. If they discovered his true identity, he was doomed. "Any Frenchman carrying a camera in a military zone will be shot without trial."

There was no time to think of focus, distance, the right lighting, or to look at the exposure meter. The Frenchman had a camera attached to his ankle, with a cable release leading to his pocket.

When the Nazi officer commanding the firing squad cried "*Feuer!*" the Frenchman's hands trembled, but he managed to snap the cable release. He brought his picture back safely. It showed five innocent people dying in front of German guns and convinced thousands throughout France that their place was with the patriots. Seeing is Believing.

After a recent raid on Cologne, Goebbels accused the Allies of "cowardly hitting only religious objects and hospitals." He also

Smuggled evidence by the Underground's camera Eye of hangings of patriots in Prague, Czechoslovakia.

What the "master race" of Europe thought of child, mother and grandmother in Greece. "I have no desire to wage war against women and children." So bellowed Hitler in his Reichstag speech in 1939.

assured those who cared to listen that the Krupp Works in Essen were only "slightly damaged."

Eight days later small photographs mysteriously appeared everywhere in Germany. Two by three inches, you could easily hide them in your handkerchief or in the cuffs of your trousers. They showed the Dome of Cologne almost undamaged amid general destruction, bomb craters, pillars of black smoke rising up from levelled blocks. Other pictures gave a view of the Krupp Works—a shambles. A caption on the reverse side quoted Little Liar Goebbels, "Krupp Slightly Damaged."

No comment necessary. The old Chinese proverb "One picture says more than a thousand words" had debunked the Liar.

After the first, low-altitude Royal Air Force raid on the Renault automobile works in the Paris suburb of Billancourt, on March 3, 1942, the German propagandists went hysterical about "the merciless bombing of women and children." Radio-Vichy said that the factories were "hardly touched." Some Frenchmen believed those fairy tales—until they found small photographs on boulevard benches, in the *Métro*, in their cigarette packages. Photos showing the blasted roofs and torn girders of the Renault works—and incidentally, brand-new, swastika-painted trucks and tanks, destroyed by the bombers.

The timely appearance of those pictures was no mere coincidence. Subsequent Gestapo investigations proved that they were the work of organized photographic sabotage units.

Once again the Nazis are beaten with their own weapon. Photography has played a paramount part in Nazi propaganda. Up to 1942, when things got too tough, each regiment of the *Wehrmacht* had its photographic propaganda outfit. When the Nazis invaded Norway, 300 cameramen were attached to the combat units. Crack cameramen, put in vanguard positions before the raids started, made the brutally realistic newsreels of the bomb-

Continued

Secret Eye of the Underground

ing of Gdynia, Warsaw, Rotterdam, which were later used to impress the leaders of nations-to-be-conquered. At one time neutral newspapers were flooded with pictures of Nazi soldiers "fraternizing" with the population of subjugated countries. Nazis dishing out food to starved Greek children (the food was taken away after the pictures were made). Poles "heiling" a swastika (actually, the people were told, "Those who want meat raise your hands," and then the picture was made). Fake pictures in Nazi papers showing "food riotings in America" (simply by replacing the background of photos taken in Germany).

There were the "demoralizing" pictures of Chetnik patriots in Jugoslavia hanged to lampposts. The pictures appeared in American publications. In Jugoslavia they didn't greatly impress the people. They had their own pictures—showing German officers killed by the guerillas. After that, the Germans stopped distributing photos.

Three days after the complete destruction of Lidice, small photos of the village, as it had been, appeared throughout Bohemia-Moravia. Underneath was an old Czech slogan, *"Byli jsme a budem"* —We Were And We Shall Be. No wonder that the Nazis hate illegal photography as much as TNT sticks, time bombs, disrupted railroad signals.

Day and night the underground photo-commandoes are at work, sabotaging German morale, bringing hope and truthful information to the enslaved peoples. Taking illegal pictures is no fancy hobby like shooting bathing beauties or sunsets. It's a tough, unglamorous game, making you stand with one foot in your own grave. On April 29, 1942, the Nazis shot ten people in Haugesund, Norway, for circulating photos of a recent raid on Paris. The Quisling authorities ordered the confiscation of all cameras in Norway. In October, 1942, [*Continued on page* 142]

Polish women in Palmiry being led to place of execution by German soldiers. Underground Eye went along secretly.

"Girls from Lidice." Courage's answer to savage butchery by Nazis. "We shall live again" reads patriot's print.

Polish civilians digging graves for murdered brothers. They'll be shot also as soon as grim work is finished.

KNOCKING DOWN MY TRIPLE

by Maj. Eugene P. Roberts
U. S. 8th Air Force Fighter Command

(Maj. Eugene P. Roberts, of Spokane, Wash., became the first American fighter pilot in the European Theatre of Operations to shoot down three enemy planes in one day. He added his fourth a week or so later, and by the time this story appears in print should have the five that makes an "ace." Maj. Roberts is a graduate of Gonzaga University, and is married to the former Jean Updegraff, of Casper, Wyoming. He is a squadron leader in an 8th Air Force Fighter Command Unit.)

YOU read a lot about dog fights in the newspapers and probably see approximations of them on the screen. The intimation is that a fighter pilot goes out hell-for-leather on his own, picks scraps with any enemy planes he runs into and, pretty generally speaking, is playing to the gallery all the time.

Up until this time I have been on 52 missions and I haven't seen a handful of that kind of fighter, probably due to the fact that a lone wolf doesn't last very long.

A chap who doesn't believe in team-work either gets knocked down, or is removed from operational missions, because he is likely to be more dangerous to his fellow fliers than he is to the Jerries.

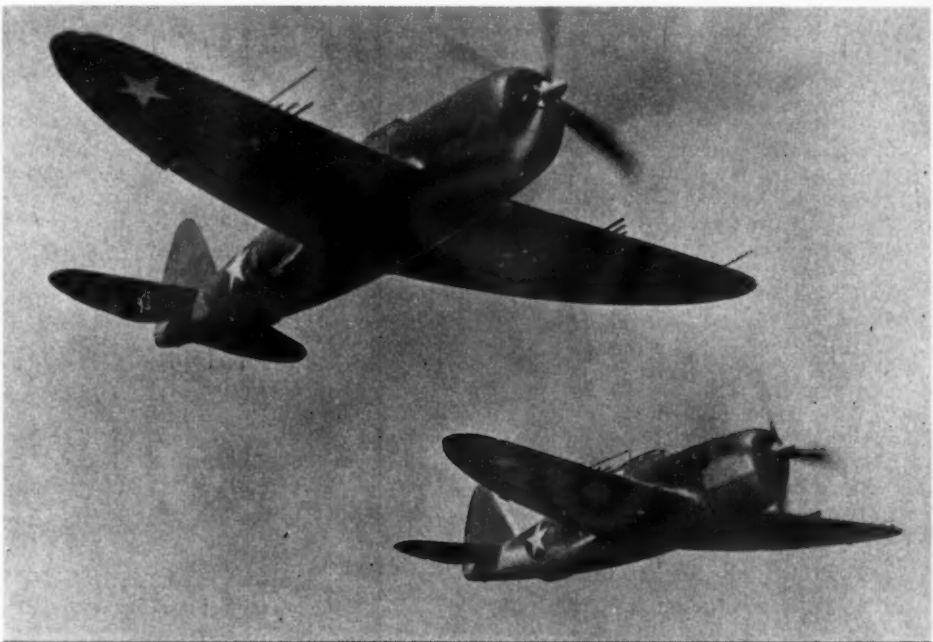
Team-work in the sky counts for as much as it does on the gridiron or diamond, and you can imagine what would happen if the members of a baseball or football team all decided to do just what they pleased, without regard to anyone else. It would be the darndest jumble you ever saw. The possibility of trouble is increased a thousandfold when a force of Thunderbolts escorts a large formation of Flying Fortresses, and runs into an equally large collection of Focke-Wulfs and Messerschmitts that are bent on knocking the bombers out of the sky.

No one who hasn't seen such a fight can possibly imagine what it is. The Forts go rolling on their way, fighting off the attackers with the dozen or more .50 calibre guns each of them carry. They are tough babies on defense, those B17's, and can take their own parts against pretty heavy opposition. The sky is big, but it looks awfully jammed, for the bombers take up a lot of room, and with hundreds of fighter planes rolling and diving and blazing away with their machine guns and cannon, hell would look like a rest cure compared with it.

It may seem strange to anyone who has never flown a fighter plane to be told that there can be team-work in that chaos . . . between twisting, diving, shooting ships, travelling at incredible speeds, but there is. I found that out a long time ago, or I would not have lived through 52 missions . . . maybe not even five.

Every fighter pilot wants to be an "ace." To be an ace you must be credited with destroying five enemy planes. It is a laudable ambition and before this was is over there will be quite a few of them scattered from England to the Southwest Pacific. The man who shoots down Jerries and Japanese gets medals and citations, and even, on occasions, newspaper headlines.

Unfortunately, in such team-play as is needed in the fighter tactical scheme, all the boys can't have a chance to become aces any more than every member of an eleven can be a Red Grange or a John Kimbrough. Somebody has to do the blocking and the heavy work up front, and, as valuable as these men are, the spectators who watch the ball carrier, pay no attention at all to them.



"Just as the blocking back makes touchdowns possible, so does the 'wing man' make aces."

Just as the blocking back makes touchdowns possible, so does the "wing man" make the bag of the aces possible. Wing man? Probably you've never heard of him. Most folks haven't. He lives in obscurity so far as the public is concerned, but in the eyes of his colleagues he is quite a guy.

Drop into any fighter mess in the evening and listen to the talk. Make it an evening after a good day. Maybe one or two of the boys have knocked off a pair of Jerries each. They get a verbal hand for that, but there won't be any lack of cheers for the wing men.

either, even if they haven't been able to fire a single burst. They have done their share, even though there are no hits in their box scores. Without them the stars might not have been able to make any hits, either.

The wing man's job is to protect his element leader and to hell with any personal score for himself! He watches for other ships and reports enemy aircraft in the area. Besides taking care of himself, which is no small job in the air over Europe, he sticks to his leader's tail, and follows him into combat in spite of diving and turning. He is always with us and, because of him, we are able to go gunning for Jerry without having to worry about somebody slipping in to knock us off.

Because of the speed with which everything moves, a man can't see everything. Suppose you whip down from twenty-five thousand feet to smash an enemy ship with a burst from your machine gun. You may aim to pull back into the sun, but before you can do it another Focke-Wulf or Messerschmitt may make a pass at you before you even know anyone is close. That's where the wing man comes in.

He does just about everything but pull the trigger. Occasionally he will knock down an enemy fighter, but only rarely, and usually when Jerry is sound asleep. There is no limit to his tenacity. I remember one who went into a compressibility dive—a vertical drop of 25,000 feet almost to the ground—when his element leader started after an enemy plane. He pulled out just above the tree tops. It was a close brush with death for both the fliers. When he was asked why he had taken such a chance, the wing man grinned.

"They told me to stick to the boss, and I believe in obeying orders," he said. "It's all part of the game, and so long as we are winning everything is all right with me."

Yes sir, the wing man may not have many planes chalked up to his credit, but if it wasn't for him we wouldn't have, either. He really is a joy forever.

I can't give you any more concrete evidence than by telling what happened on July 30, 1943. Three Jerries were added to my score that day, but half the credit, anyway, should go to Flight Officer Glenn Koontz, out of Racine, W. Va., who was riding wing for me on that mission.

A fellow feels a little jittery before taking off, like a prize-fighter sitting in his corner waiting for the bell to sound. We are thoroughly briefed by intelligence and operations and weather officers. They tell us about everything we might be expected to run into in the way of fighter opposition and flak and clouds, to say nothing of the tactical plan for the day. It is stuff we need to know in detail, and everyone is intent and earnest, but hearts are pounding hard. This isn't a party. It is the most serious business in all the world. Don't be fooled by that hero stuff. We aren't heroes. We can get scared and we do get scared, but mostly during that waiting period.

When you come out of operations in your flying clothes and parachutes and hear the Thunderbolts warming up with a deep, sweet roar, and see the faces of the crewmen who keep the planes in fighting trim, some of the tenseness goes out of you. The fight is coming closer now. It isn't much of a hop . . . only a few minutes . . . across the Channel to France or Belgium or Holland. That's how close the front is to the flying fields of England.

When I came out that morning my crew chief, Technical Sergeant N. H. Sapper, of Nobelsville, Ind., greeted me with a rather pessimistic note in his voice. I knew what was wrong with him. My plane, the "Spokane Chief," was in the hangar undergoing repairs, and I had to take another one for this mission. Crew chiefs are hard to wean away from their pets. No other ship on the line is ever as good as the one on which they lavish their skill and work.

"This one is okay, Major," said Sapper, "but I wish you had the 'Chief' for this run. I got a hunch it's going to be 'busy.' "

"Don't worry about it," I told him. "She'll be ready for the next one."

I climbed into the cockpit, wondering if Sapper's hunch was right. You never know when you take off. Sometimes you expect trouble, but don't see a Messerschmitt or Focke-Wulf in the sky. Next time you may think it will be easy, and run into a million enemy aircraft more or less.

I didn't waste much time about that, for my thoughts turned to my wife. They always do when I settle down in the cockpit. Jean and I were married in California, but were together only ten days before orders came for me to go overseas. Fighting men must live on memories, and it's pretty lonesome that way.

There is a real thrill in taking a Thunderbolt up into the sky. It is a fine ship, with a world of power packed into the engines, plenty of armor, and eight .50 cal. machine guns in the leading edge of the wings. They can take a lot of beating and hand out plenty, too.

In a little while [*Continued on page* 160]

NAZI SECRET WEAPON

PREMIER WINSTON CHURCHILL, in a recent speech, revealed that the Nazis have introduced a secret weapon into the war. In Mr. Churchill's words, this weapon is a "radio-controlled, rocket-propelled glider bomb." Willy Ley, MECHANIX ILLUSTRATED expert on weapons, directed MI Artist Reynold C. Anderson in drawing the accompanying conception of this weapon. Mr. Ley brought the photograph (below) out of Germany several years ago. It shows a type of rocket glider perfected by the German inventor Reinhold Tiling [*Continued on page* 147]

General MacArthur leading the first U. S. Paratroop operation in the Southwest Pacific. Like a youngster he cries: "Beautiful," as Markham Valley attack begins.

MACARTHUR— MASTER OF AIR POWER

by Major Malcolm Wheeler-Nicholson

GENERAL DOUGLAS MACARTHUR has been more extravagantly praised and more hastily condemned than any high ranking officer of the United Nations. The majority of air men hold thumbs down on him for two reasons, neither of them supported by evidence. Because he was one of the officers who sat in judgment upon General Billy Mitchell's court-martial, and because MacArthur's airpower was destroyed on the ground in the Philippines, ten hours after the Pearl Harbor air forces were destroyed in the same manner, too many air men overlook the actually superb skill Douglas MacArthur has shown in his use of airpower in the South Pacific. Not only has he shown superb skill

but he has accomplished such results that the pathway he has blazed may yet prove to be the quickest and most effective route to Tokyo.

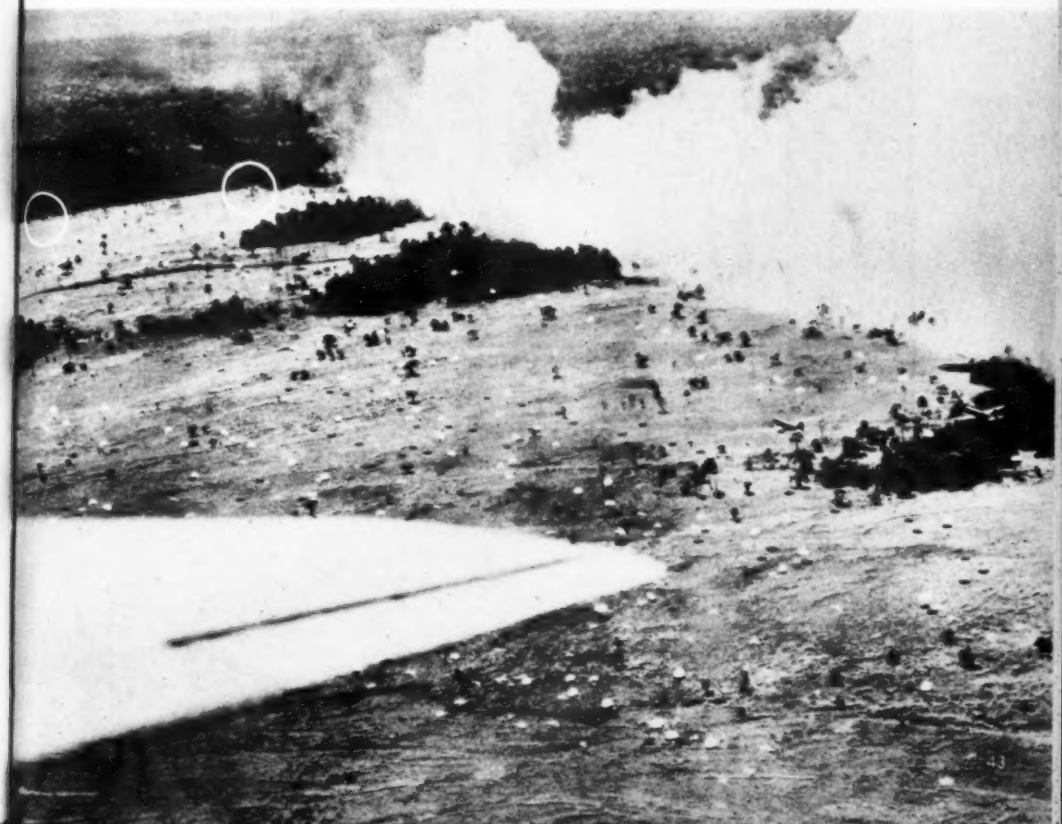
That General MacArthur sat upon Billy Mitchell's court-martial is no criterion—the vote being secret, he might just as well have voted for as against General Mitchell. That he lost his airpower in the Philippines, through his own fault, is a charge as yet unsubstantiated by the evidence available.

What *is* available is a mass of incontrovertible evidence, since then, showing skilled adaptation and co-ordination of perennially small and insufficient airpower means to vast tactical and strategical ends in the South Pacific, one of the most difficult areas of this global war.

His arrival in Australia at the darkest hour was like a bugle call rising clear and high above the mutterings of discouragement and dispelling the whisperings of fear in that far off continent. The doughty Australians and New Zealanders had reason to worry. Japan's octopus tentacles had swiftly encircled and overwhelmed the Philippines, Malaysia and the Dutch East Indies. Singapore, that mighty fortress whose guns faced the wrong way, had fallen. The Jap tentacles were steadily snaking nearer and nearer to Australia. They had coiled around Sarawak in Borneo, around the Celebes. They were slithering into New Guinea and were less than 1,000 miles from Australia. Rabaul, with its magnificent harbor and its twin air fields had fallen. For the first time Japan had advanced and conquered south of the equator. She had, in a few swift hours, captured one of the greatest natural defense points and naval and air bases in the South Pacific. She swooped down and captured Lae in New Guinea. Only one Australian base stood between the Japanese and the Australian mainland—Port Moresby with its tiny garrison. Its air force consisted of a handful of slow Catalina flying boats and Lockheed Hudson reconnaissance bombers and an old Australian Wirraway, minus one wing.

But, when the fever-racked Australian garrison at Moresby was at its lowest ebb, a

And this is what the General saw to excite him—his paratroopers descending to bottle up the Japs in the Lae-Salamaua sector of New Guinea. Two transports (circled) unload.



The Commander-in-Chief of Allied Forces in the Southwest Pacific on a tour of inspection before boarding a plane for new New Guinea.

wave of hope ran through it when word came of the arrival in Australia of the first large American convoy bringing help.

The great Republic from across the sea had come to the aid of its hard fighting allies "down under."

To the handful of indomitable Australians at Port Moresby, the first symbol of that aid came in the form of a group of Flying Fortresses. These were joyously welcomed. But what the sorely beset Australians really needed were fighter planes to humble the arrogant Jap Zeros and Mitsubishis which had had everything their own way for so long.

Rumors that a squadron of Curtis Tomahawks was on the way to break up the leisurely Jap bomber formations persisted so long that the disappointed Australian soldiers dubbed them "Tomorrowhawks." The Jap, with a canny regard for the realities of airpower, based his every move on fighter support, projecting each forward move within the effective range of fighter planes. In accordance with this, the Japs rapidly made Lae and Salamaua into strong bases readying their air forces for a powerful blow at Port Moresby.

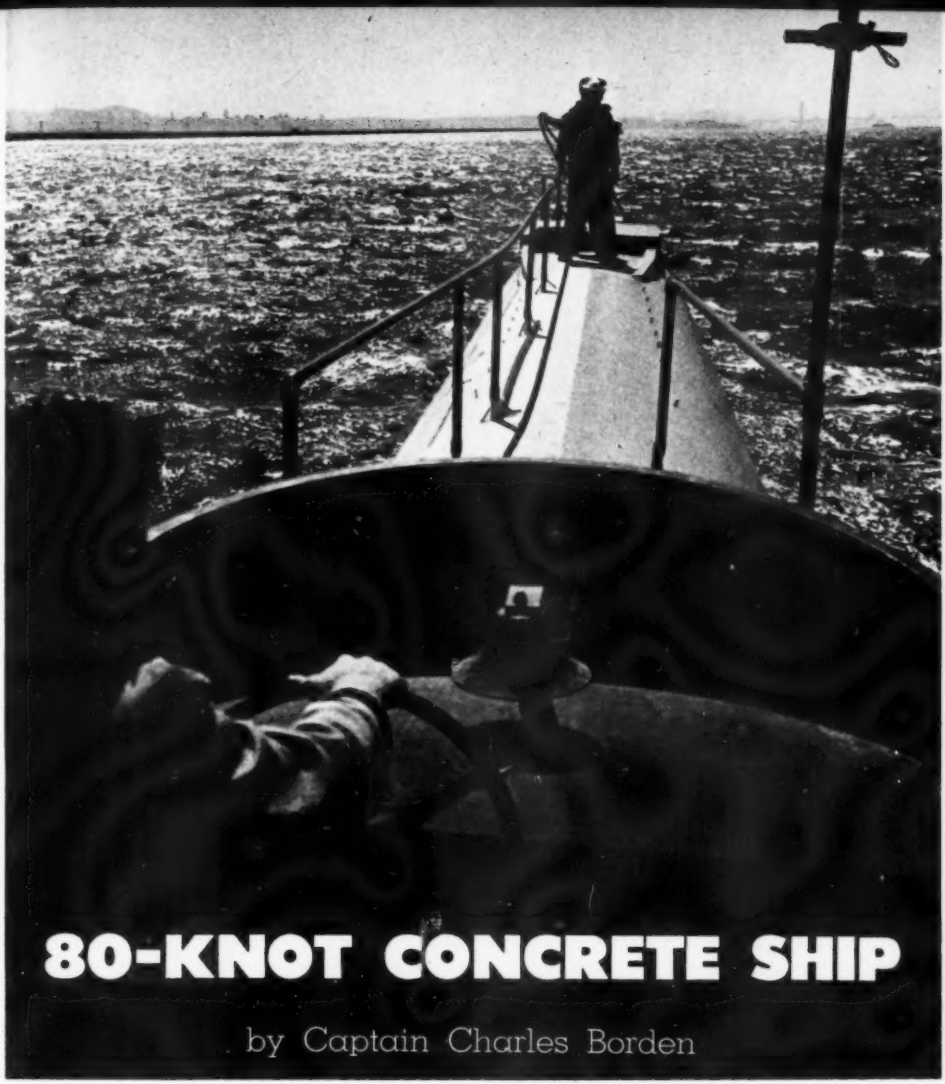
And then General Douglas MacArthur landed in Australia. His arrival did more to lift morale on the Australian mainland than any other single factor. But opinion among the fighting men at Moresby as reported by George H. Johnston, the Australian war correspondent, varied from one officer's "He is the greatest fighting man in the world," to another's "I can't get out of my mind the fact that he's just another of the United Nation's fifty defeated generals." The attitude of the Australians on the far outposts could generally be summed up as "wait and see." They had not long to wait.

One day four strange fighter planes came swooping down on Port Moresby airfield. The machine gunners and anti-aircraft blazed at them. Luckily they registered no vital hits. The four strange planes were followed by a strong squadron of the same types—not the long expected "Tomorrowhawks" but P-40's-Curtis "Kittyhawks." Twenty minutes after the "Kittyhawks" came in, a Japanese bomber appeared, making its usual leisurely reconnaissance that had been a daily feature for weeks. One of the Curtis fighters rose like an angry wasp, streaked at the invader and while thousands of men watched joyously, dived on to its tail, with guns chattering, until the bomber fell among clouds of greasy smoke upon a reef in the harbor. Hours later the troops were still cheering. The Aussies that passed the airfield with the sleek fighters lined up, shouted out "You bloody little beauts!" That night liquor in Port Moresby flowed like water.

Douglas MacArthur was beginning to function.

Then came the B-26 Glenn Martin Marauders, with American pilots, and the Japanese at Lae were treated roughly by a swooping visitation of Marauders and Kittyhawks, sixteen bombers and fighters were destroyed among 24 Jap planes caught on the ground. Fresh-faced American youngsters were pouring into Australian ports, receiving a tumultuous reception. Young American pilots appeared in greater and greater numbers in New Guinea.

But the Japs were not idle. Japanese planes began to pour into Rabaul, Kavieng, Gasmata, Lae and Salamaua. Rumors came of a great Jap naval force moving southward. The Japs, having waged some 12 separate campaigns to start with, had successfully narrowed resistance [*Continued on page* 148]



80-KNOT CONCRETE SHIP

by Captain Charles Borden

The revolutionary new-type ship, Lektron, as viewed from its bridge on its test run.

THERE is a buzz of excitement among naval experts and representatives of the press, as Lektron, the torpedo-shaped submarineship travelling 70% submerged, knifes smoothly through the waters of San Francisco Bay at a spectacular rate of speed.

"It's incredible," an excited maritime official exclaims to a naval officer, as they crouch forward in the semi-conning tower of the strange new ship of the future.

Half-submarine, looking somewhat like a new Churchill cigar, Lektron is the forerunner of a fleet of 400 ft., cylinder-like freighters designed to travel at speeds up to 80 knots.

Built almost entirely of a secret, resilient aggregate and wire mesh, this concrete fantasy weighs but 22,000 pounds, is 124 feet long with a 7 foot beam. Costing over $80,000, it travels nearly three-fourths submerged when fully loaded, has a 5,000 mile cruising radius and space aboard for 55 tons of cargo.

Hal Hayes, the designer and builder, is a modest, likeable young fellow of thirty-one. Having built more concrete homes than any other builder in the world, he is known throughout the United States and in foreign countries to the builders who use his revolutionary concrete methods as the "Ford of the

Mechanix Illustrated Art
by Fred Ripperda

Artist's version of a luxury cruiser of the future based on design of the new Hal Hayes Lektron idea.

building industry."

Sweeping aside the cobwebs of conventional marine design and shipbuilding, Mr. Hayes, with twelve years' experience in experimenting with and perfecting of concrete in ship construction, applied his knowledge to a design that would dispel the general notion that a concrete ship must be slow and cumbersome. The result is Lektron, the nearest thing to a perfect streamline that has ever been achieved in a sea-going surface vessel.

Adaptable as a freighter, tanker or troop transport, Hayes is making plans for a fleet of 10,000 ton concrete semi-subs designed for speeding troops and cargo safely across the ocean in torpedo-shaped hulls.

Have you ever tried to bend, bounce or stretch a piece of hard cement? Well, before you laugh at the question, just try to imagine a block of cement with such qualities that you can easily cut it in two with a common saw. Picture a slab of it that is nearly as light as wood and so pliant and flexible you can bend it into a complete circle as if it were rubber.

Seems inconceivable, doesn't it? But that's exactly what I saw inventor Hayes do with his rubbery concrete. He has, in fact, even used it in a set of truck tires, with fine results.

Although but one and one-fourth inch thick, the hull of Lektron has as much strength and is tougher than a four inch hull of cement generally used in ship construction. Pumice from the Mojave Desert makes Hayes' concrete 50% lighter than ordinary cement.

In an official examination by the Maritime Commission before it was ever launched the Lektron was subjected to the severest test that can be given a ship. It was blocked up on the extreme tip of each end, leaving no support whatsoever in the center.

One official openly admitted he expected to see it break in two, but the hull center never

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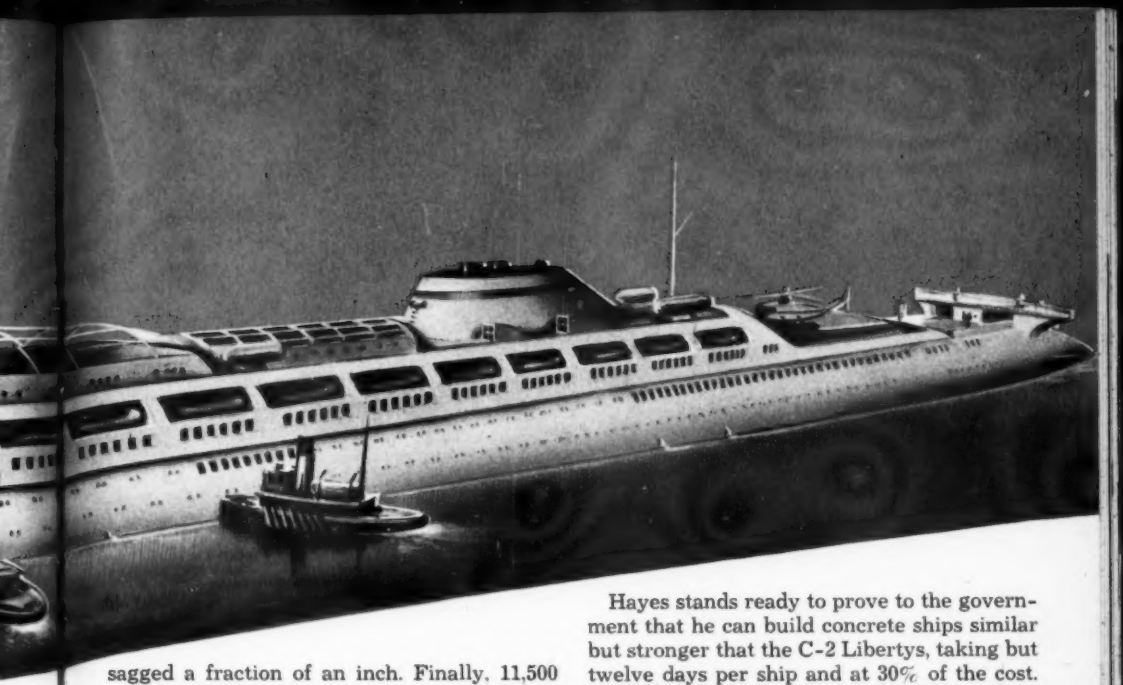
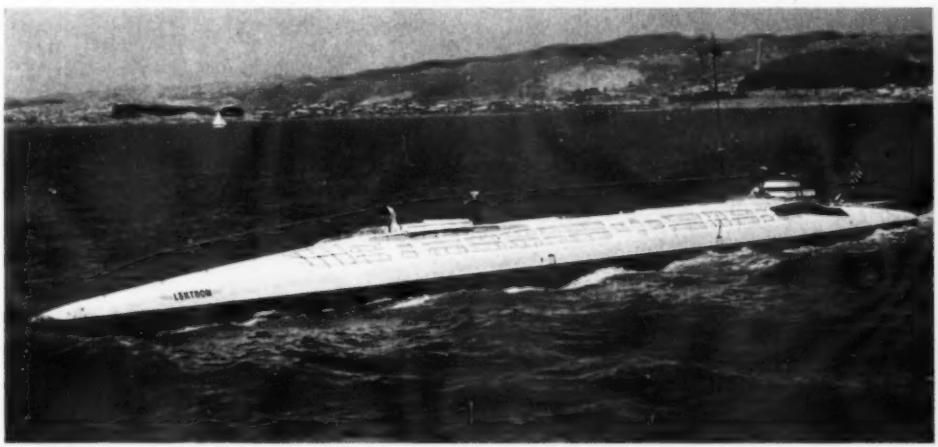
80-Knot Concrete Ship



sagged a fraction of an inch. Finally, 11,500 additional pounds (over one-half its own weight) was placed in the center of the vessel and it sagged but one-sixteenth of an inch and showed absolutely no checks or cracks. In comparison, if similarly tested, no Liberty ship being built today could hold its weight without sagging. Further in comparison, where a steel Liberty ship requires countless beams and girders to give its hull strength and to prevent its plates from buckling, Lektron's amazing strength is wholly in the concrete hull, having no bracings, beams or hull supports whatsoever.

Hayes stands ready to prove to the government that he can build concrete ships similar but stronger that the C-2 Libertys, taking but twelve days per ship and at 30% of the cost. He'll use mostly unskilled labor and only one-tenth the precious metal required in a Liberty ship. Much stronger than the Libertys, by eliminating built-in stresses, they would travel twice as fast, carry twice as much cargo and, built in three sections, would stay afloat even if two sections were destroyed. Having no seams or rivet holes, they would be practically leak proof. (A concrete ship still in service on the Pacific Coast has not once in twenty-two years of coastal sailing found it necessary to use a bilge pump.) And where a steel ship would buckle and sink if afire the

The Lektron takes off on its test cruise—furnishing a basis for the futuristic ship above.



new concrete ship is absolutely fireproof.

The most unusual feature of the futuristic Lektron and one of the prime factors in giving it such great speed is a 27% reduced skin friction on the entire hull.

A steel Liberty or Victory ship not only has countless obstructions to wind and sea above the waterline, but at full speed below the waterline many things, including the steel plate edges, cause a high resistance and loss of speed.

Requiring no keel because of inherent stability, Lektron cuts wind and water resistance to a degree never before reached on a sea going cargo vessel and reduces overall sea movement to an absolute minimum. Her design and stabilized metacenter prevent any rolling and her length and low displacement prevent toss and dip.

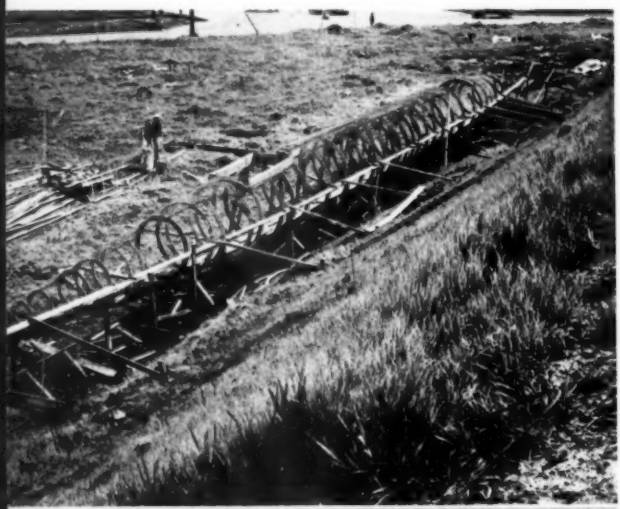
"A hurricane would have no more effect on her than on a healthy fish," Mr. Hayes explained, "for inherent stability makes her impossible to capsize and streamlining gives her the sea riding qualities of a huge Dolphin."

The Axis would have little chance to spot and no chance at all to stop a fleet of these vessels racing through the darkness at 80 knots.

To Hayes the Lektron design is more than a vital war weapon. He plans it to be the most important contribution in its field to the post war "world you never knew."

With that in mind I asked Mr. Hayes for his opinion of the 20th century future-liner.

"By using discoveries that we have made in the development of our light-weight, high speed cargo craft in connection with a ship design of new approach and a discovery that greatly reduces friction between the hull and the water, [*Continued on page* 150]



The radically new construction idea involved in the Lektron is shown in these pictures. Above, the framework is set up.

Once the steel and wire-net framework is set, the Lektron is built by applying successive layers of "aggregate," as above.

Hal Hayes, youthful movie man and designer and builder of the Lektron, demonstrates flexibility of his "aggregate."

The firing position of the Bazooka. Rocket reaction, which eliminates recoil, is harmlessly spent from rear of tube. For earlier pictures see the July M. I.

The rocket projectile. Instead of slowing down like a bullet, there is a velocity pick-up in the air.

THE BAZOOKA

THE artillery of the future will probably owe much to the small, short ranged but so far irresistible Bazooka. A stovepipe type of rocket gun with a projectile that looks like a little elongated aircraft bomb, it has been equally deadly against tanks, thick brick walls, rock masonry, structural steel and railroads. This weapon is somewhat more than 50 inches in length and less than 3 inches in dia. Its projectile is nearly 2 feet in length.

At Camp Carson, Col., President Roosevelt watched the firing of the rocket gun last April. In this case the target was 75 yards away. No tank which has been in action has Bazooka-proof armor.

AMERICAN DAVINCI

by Bernard Wolfe

DR. GEORGE SPERI SPERTI, short, plumpish, 43-year-old director of the Institutum Divi Thomae and former Principal Consultant to the War Production Board, holds patents worth well over $1,000,000 but seldom has a penny in his pocket. Blithely unconcerned over details of money, railroad schedules and hotel reservations, he distresses the staff at his Cincinnati research center when he dashes off to catch a Pullman or a stratoliner.

These days he is constantly on the move. He has made numerous hurried trips to Washington to confer with Donald Nelson and other high officials on new plans for mobolizing the nation's 200,000 scientists, or to discuss with the nation's agricultural experts projects in chemurgy (the industrial use of farm products), or to give to the rubber committees reports on the value of the Strangling Fig Tree (*Ficus aurea*), etc., as sources of latex to alleviate the rubber shortage. Sometimes he is called away to a ceremony in his behalf: he has received honorary Doctor of Science degrees from the University of Dayton and Duquesne University, the Catholic Action Medal from St. Bonaventure College as the outstanding Catholic of 1942, the Mendel Medal from Villanova College for outstanding achievement in science in 1943, and nomination by Pope Pius XI to the Pontifical Academy of Sciences, whose roster includes the names of Alexis Carrel and Marconi. Occasionally he is scheduled to lecture on his new biodyne-ointment treatment of burns and skin wounds before some scientific body like the Society for Experimental Biology and Medicine or the American College of Surgeons and Physicians, or to confer with members of his field staff in Florida who are trekking through the Everglades with Seminole medicine-men as guides, looking for new drug-yielding plants. Whenever he goes off on a trip, an associate manages tactfully to tag along, to make sure that he gets where he is going and has a

Dr. George Sperti, informal practical wizard of field and laboratory.

Sister Ann Gertrude preparing a set of manometers for experiment on tissue respiration.

place to sleep. If he travels by car, his colleagues do their best to keep him from the wheel. "He's the most meticulous man in the laboratory," one of them confesses ruefully, "but frankly, when it comes to driving, he passes more red lights than anybody in town."

Dr. Sperti, his friends point out, has little in common with the type of unworldly professorial recluse encountered on American campuses. He is embroiled in as many earnest practical matters as any earthbound business executive. When he takes time off from organizing research experts in the WPB's Office of Technical Development, now known as Production Research and Development, he busies himself with the founding of a new cancer laboratory or clinic, or sees to the affairs of Sperti, Inc., the booming concern which manufactures many of his patented inventions, from sunlamps to cosmetics, from which Dr. Sperti personally receives no profit.

Although responsible for some of the most

No doubt this is an invaluable egg. In the laboratory in Cincinnati, Ohio, Sister Thomas Aquinas obtains a chick embryo for the amazingly productive Sperti cancer experiments.

spectacular headlines from the science front, Dr. Sperti is publicity-shy and upset by crowds. He has been known to bolt at the sight of a photographer or reporter. But with people he knows and likes he becomes extremely affable, with a disarming warmth that betrays his Italian origin. He often goes off with his associates on hunting and fishing trips, which he prefers to indoor conferences around a table. Frequently he indulges in little pranks which remind his friends that he was once renowned as a mean spitball wielder in the public schools of Covington, Ky. He is not above hiding a testtube on one of his colleagues, or snarling his fishing lines.

Dr. Sperti's serene indifference to timetables and traffic lights is due, his friends believe, to his energetic curiosity and his penchant for speculation about things to come. Preoccupied constantly by how cells grow, the construction of ultraviolet lamps, the freezing of meat, black light,

Continued

American da Vinci

Co-ordinated research gets the chance of a lifetime in the Institutum Divi Thomae. Among the numerous inventions of devices, methods, preparations, processes—there is also life!

cold light, the construction of an artificial pancreas to eliminate insulin injections for diabetics, the chemistry of cosmetics, the bombardment of milk with vitamin-producing rays, the design of aeronautical navigation instruments, seaweed that yields agar-agar, sunlamp treatments for tuberculous patients, silkworms, sanitary engineering, polyphase-factor power meters for measuring power consumption of factories, germicides, synthetic rubber, anti-malarial and anti-dysentery drugs, electric razors, ergot, squill, detoxifying vaccines, sterilizing enzymes, correlated investigations in the basic sciences, and the quantum theory in biology. These things are apt to make him forgetful.

The key to George Sperti's personality may be his multiplicity of interests. Ever since he received his degree of Electrical Engineering from the University of Cincinnati in 1923, at the age of 23, he has been impatient with scientists who hole up in their specialized cubicles and pursue lone-wolf careers, without bothering to keep up with what's happening in other fields. He firmly believes in letting the inventive curiosity wander and prowl, irreverently hurdling the time-honored barriers between physics, biology, mathematics, chemistry, and the other cubby-holes of science. [*Continued on page* 157]

BULLET-DODGING HANDYMEN

Front line repair men removing a damaged tank under enemy fire. The tank very soon fought again.

by Beryl D. Kneen

IN THE heat of battle, what is that yelling that raises the roof? It isn't a cry for Hitler's hide, nor even for the Four Freedoms. It's a big bellow for Joe, the repair man!

In this war of the robots, "For every man with a gun there's almost half a man with a monkey-wrench." And the gun-toter, like as not, has a screwdriver and a pair of pliers in his hip pocket.

The Army, no longer travelling on its stomach, scoots about in jeeps, half-tracks, tanks, trucks, planes and mobile artillery pieces. And the "fixit guy" travels right along, for he's the kingpin of this war. He is the fore-handed chap who had ready-made plugs in his pocket when the landing-boats beached in Sicily—to plug the bullet-holes.

As an ordnance officer said to me: "A man can get along a couple of days without grub, but he can't get along five minutes if his tank breaks down in the middle of a battle. Somebody has to put it back into the fight—preferably the tank crew. If they can't, there'll be some mechanics pretty close behind them who will get her rolling again."

The repair genius isn't getting many decorations—except maybe the Purple Heart, after someone takes a shot at him while he has his head under the hood. But he's there in the thick of things.

Take the Ordnance Department repair men. Everything that rolls and shoots is bought and repaired by Ordnance. Whether attached to Infantry or Air Corps, the repair man was probably trained by Ordnance for battle "jiffy-jobs." These handy men procure, ship and repair the artillery, trucks, tanks, repair shops, jeeps and all other motorized equipment. They don't order the planes but they do procure the bombs and guns that go into these planes and other Ordnance trained men haul the big block busters up on trailers, put the fins on them, load them with TNT, fix up any damage that may be incurred in shipping and stick them in the bombracks. The Air Corps takes over from there.

Repair men are figured in the plans for every big battle today. For every operation, such as the taking of Sicily, a task force is made up of troops to fit the job. So many

infantry, so much artillery, so many plane squadrons are decided on. On these planning boards is an Ordnance officer. One of his jobs is to decide how many repair men will be needed to keep the outfit moving.

In an invasion the first job is a beach-head. Looked at from the repair man's angle the first troops ashore are "stripped down" troops. They carry only the minimum to take and hold the position. In their pockets and about their persons are bare essentials that will enable them to keep shooting and do such things as unjam a machine gun.

Right behind the "stripped down" troops follow a group of "stripped down" repair men. Selected because of their thorough knowledge of the troops and equipment just ahead of them, they bring the minimum of tools and parts to do the things that can be done quickly in the midst of a hot scrap. These are the Second Echelon repair men.

The line between what the Army calls First Echelon repairs and Second Echelon repairs is somewhat thin and wavering, but the following incident is an example of First Echelon repairs, which means in non-Army language, that the equipment is repaired on the spot.

A small Marine Corps group was attacked by a wave of Japanese for four days and nights without rest. In the hottest part of the fight a machine gun jammed. Private James M. Hill of Baltimore, Md., remembered that he had a tiny nail file given him by his sister. He dug it out. The gunner hastily stripped down the gun. The ejector was bent —a thousandth or so—it had to be filed off at the top. The little nail file did the trick! The gun was slapped together and began hurling bullets back at the Japanese before they were able to gain any advantage from the pause. First Echelon repairs.

Fast portable battery chargers, 100 ampere, are used at the front. They can roll along a line of motorized vehicles and step up each weak battery in five minutes. Overcharging is controlled by a thermostat. The Germans broke down at the Russian front last winter because of run down batteries which freeze at 20 degrees above zero, while a fully charged one can take cold far below that.

After Second Echelon Repairs, which is upkeep at the front with a small amount of portable tools, comes the Third Echelon which is one of the most interesting divisions of front line maintenance. In the Third Echelon com-

An improvised jack holding up the wing of an Army P-39 while mechanics work on disabled landing gear in South Pacific heat

Open-air mechanics and a desert workbench. Fitters repairing a radiator at the maintenance camp at a Libyan airfield. Note mobile crane.

The "A" unit of the mobile machine shop. This electric powerplant furnishes "juice" to all types of shop equipment in places where no other source of power can be had. "Juice" is blood of repair work.

panies are the mobile repair shops. Ordnance Department has nine basic truck types. Other branches use varying numbers of these basic chassis, mounting shops with equipment to suit their work.

From the air most of these shops look like the 2½ ton cargo trucks. The repair men are not anxious to advertise to the enemy air corps that a lot of expensive lathes, grinders, hoists, acetylene equipment, electric arc welding sets, blacksmith tools, drills, battery chargers and innumerable other tools are driving along ready to fix up everything but complete rebuild jobs.

Sometimes innocent appearance does not protect these shops. Recently a group of repair shops was busy with ten General Sherman tanks that had fallen behind the line of attack. German planes appeared to strafe. The maintenance men dropped their tools for guns and returned the fire. Before the battle was over the tanks and their repair men had shot down six planes. The job continued.

In a protected place at the rear Fourth Echelon repairs proceed. This is the job of complete overhaul. Work of this kind goes on at the back-of-the-line air bases and such big establishments as the great military base, which was at Eritrea and is now moving nearer the front line. This removal job is said to be one of the most extensive industrial transfers ever undertaken.

Some Fifth Echelon work, which is complete rebuilding, is done at such bases. Some corps apparently stop with Four Echelon repairs. But much rebuild work is done in England and a good deal now in the U. S.

Many heavy guns cannot be rebuilt at the front. A certain number of rounds and a gun is through. The weight also prevents long distance removals. The "Long Tom" 155 mm. gun weighs 30,000 pounds with its prime mover. So material from such pieces is cut up, compressed and shipped back to be made into new equipment.

Many specialists are required to keep our great mechanical fighting equipment at the front. The Ordnance Department has found that 13 trades are needed to keep a tank going in tip-top shape. Land battles today take on the character of naval battles. A hard fight shoots up so much material that both sides have to stop and repair damages. The final decision is likely to go to the side that can return to the battle faster with its equipment in working order. So victory may lie on the side with the best repair men. We have them, says the Army.

The Signal Corps is busier than a cat with nine kittens on all fronts. Its insignia should be a repair man up on a pole with a pair of pliers, and bullets showering about him.

Most recent of Engineer outfits are the Air-borne Engineers. They were developed to hustle up front and repair captured enemy airfields and destroyed roads, also lay pipes to get airplane fuel to the front line. Their equipment was cut down in size to fit the wide side door of the C-47 transport plane, so they travel with small-sized bulldozers, scrapers, tractors, graders, rollers and asphalt heaters.

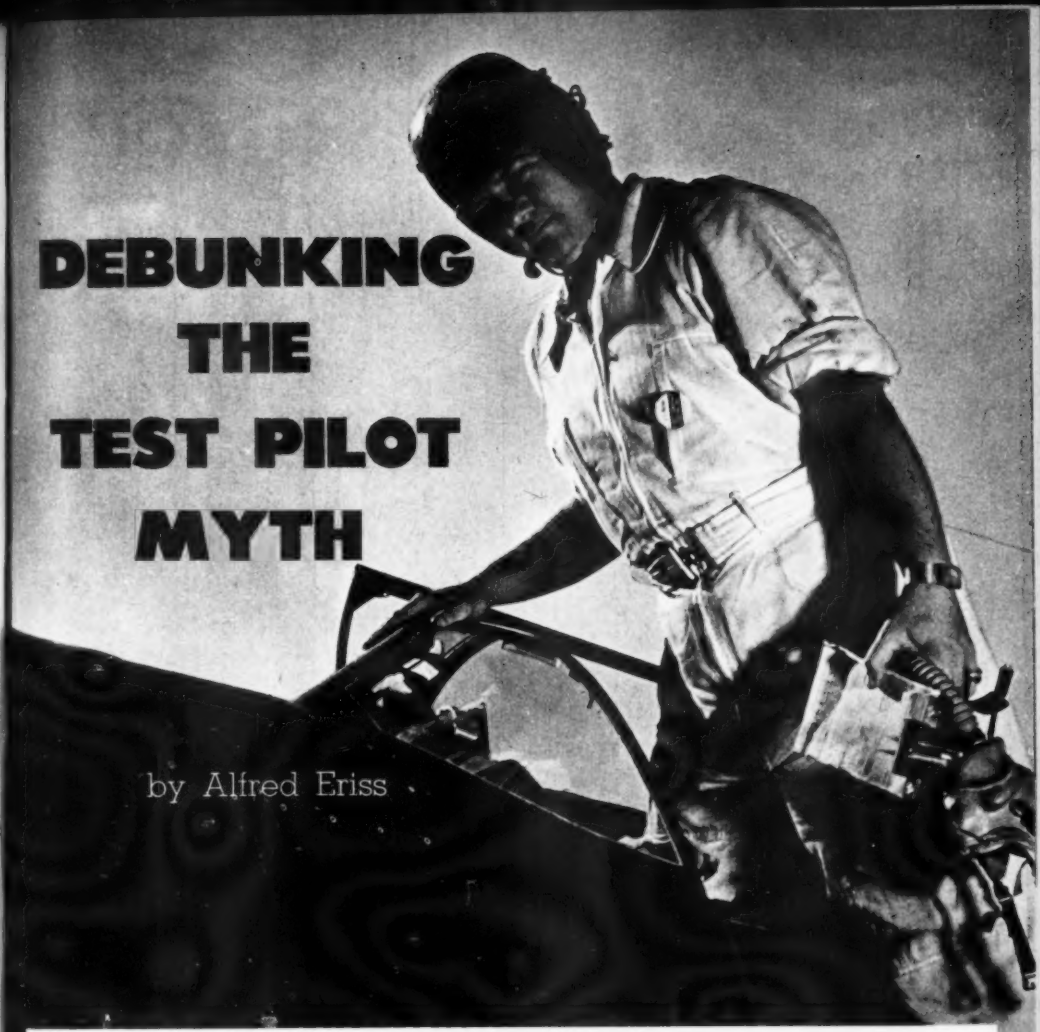
Their first job last November in Africa was to take over and repair an airfield made useless by bombing. They had to fight the remaining defenders to get it, and then work sixteen hours filling in craters. The next day P-40's began to use the field. Even the portable steel landing mats used so much to improvise and repair fields are too heavy for the Air-borne Engineers to use except in small amounts for very bad spots.

Airplanes always come to mind when repairs are mentioned.

Best known of the jobs was the creation of a new Flying Fortress, "Flying Fit and Ready to Fight," out of [*Continued on page* 147]

DEBUNKING THE TEST PILOT MYTH

by Alfred Eriss



Joe L. Barton, experimental test pilot for North American Aviation, Inc., climbs into the cockpit of a P-51 Mustang fighter. In his left hand he holds his oxygen mask and familiar "squawk pad."

THE handsome giant with blue eyes and a mop of blond hair, his belly tightly strapped with a wide leather belt, strode across the airfield to the waiting super-airplane. He vaulted into the cockpit, adjusted his gold crash helmet, his all-altitude oxygen mask. He flipped a switch and the plane streaked into the stratosphere.

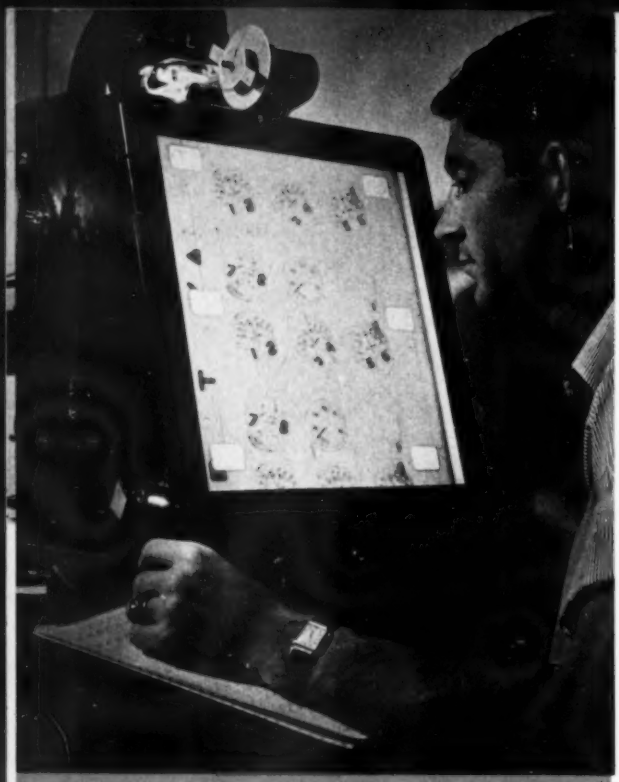
The ground crew gaped in awe as they watched him plunge his craft into a screaming 30,000-foot power dive; then shouted in fear as they saw the wings fly off the ship. Fifty feet from earth, a white 'chute snapped open and the blond giant landed gracefully. He grinned, "O.K., boys. Have another one ready within five minutes."

Do you recognize the myth of the test pilot? You've seen him in the movies and read about him in many magazine stories, this devil-may-care, reckless, hard-drinking, hard-flying Captain Marvel of the clouds.

But does he really exist, outside of myth?

Perhaps in the early days of aviation such a god-like creature existed. There were daredevils in those days, when all flying was adventure.

But to understand how far aviation has progressed, let's look at an actual



Readings of various instruments installed on a B-25 Mitchell bomber, photographed in flight and magnified.

test pilot (or, rather, pilots) today.

The public erroneously lumps all test pilots together. In practice today, there are two distinct types of test pilots: 1. The experimental test pilot (known as E.T.P.), and, 2. the production test pilot.

The first, or E.T.P., sits in at the birth of a new type airplane, works out the experimental flight test sections and is with the plane from the time it leaves the boards of the designers until the first model is completed. He is something of an engineer and designer, as well as being an expert flier. He is vital to the perfection of a new type of plane, because in spite of all the expert paper work in the world, only flight can prove a ship. E.T.P. concerns himself only with the first model of a new type of plane.

The production test pilot has an entirely different job. After a new type plane has been perfected and placed in production, it is his duty to test each new plane as it comes off the production line—simply to see that each plane will live up to its guaranteed functions before it is delivered for active service.

Out at the great plant of North American Aviation, one of the foremost experimental test pilots working on new types of warplanes is a youngish man named Bob Chilton. He is chiefly known for his keen analytical mind. Let's watch him at work:

Warplanes are a result of the submission of manufacturers' designs in answer to an Army or Navy request for a certain model, carrying a specific bomb load, cruising at a certain speed, gross weight, weight when empty, range, etc. The engineering departments of the aircraft plants draw plans to meet these specifica-

Bob Chilton, E.T.P., secures the towing pin lug on the nose wheel of a Mitchell.

tions with the Army or Navy selecting the plane they believe will suit the request best.

Of course, the test pilots josh that the "engineers are always trying to kill us with unworkable designs." The counsel of the E.T.P.'s is essential in working out the plane to suit the military need, and they can sometimes "kill" certain modifications or suggestions, before they are even incorporated in the model, solely on the basis of their flying experience. Once the ship has been built, work proceeds at a cautious, steady pace. If the ship flies for fifteen minutes, it may be gone over by the ground crew for several hours, eagerly searching for any flaws.

First time up, the pilot of this prototype, usually prefixed with an "XP," if a pursuit type, will go very gingerly; he may stay up for hours, but you won't find him plummeting down zestfully at seven miles a minute for the simple reason that his boss has not yet found a worth-while use for a dead test pilot. First models are invariably hand-built and are

Closing the rear hatch of "the ship that gave Tokyo a taste of it" before taking the plane up for a test flight.

worth ten times their weight in gold because of the work gone into them and the hopes attached to their sturdy frames; it may be weeks before your pilot will go into a dive which will strain the ship.

He'll climb, again and again, hunting for a sign of weakness; the keen analytical ability of Bob Chilton comes in right here. Ignoring or missing performance flaws would mean that such defects would be incorporated in the production lines, causing, eventually, either loss of life or expense running into astronomical figures.

During actual design of an airplane like the P-51 Mustang fighter, [*Continued on page* 151]

Examining the readings recorded on motion picture film while the B-25 test-flew.

CONTINENT OF TOMORROW

A WEATHER-BEATEN, raw-boned man told his story over Scotch and soda one night on board the Grace luxuryliner S.S. Santa Elena. He was going "back home," for the first time in forty years, he said, although a man still well under sixty.

His name was Andrew Peck. He had run away from a New Hampshire farm to seek his fortune, with only the clothes on his back. He got to New York somehow and shipped aboard an old full-rigged ship bound round the Horn for Valparaiso, Chile.

On the way back home, the Captain thought to make a short cut. Like 20 per cent of all vessels that tried to ride the 60-foot tides for 320 miles through the narrow Straits of Magellan, the ship was wrecked. Nearly all the crew drowned.

Andrew Peck made shore and struck out across Patagonia. For five days he kept himself alive on ship's stores. He had about reached the end of his rope when he came upon the hut of an old Scotch sheepherder. He made it his home.

Instead of gold and precious stones that he had set out to find in a tropical land, Andrew found sheep, wool, hide, tallow and mutton, in the coldest spot on the continent. And now he was going back to look over the old farm, with a steady income of $50,000 a year.

San Rafael glacier. Ice to arable land to seashore. Chile climate is strange.

Andrew Peck's good fortune is one among thousands of real life stories told in Chile. It does not mean that you will have to raise sheep to become a member of the lucky immigrants. Nor will you have to go round the Horn in a sailing ship like Peck. Year after year it has been getting easier to reach Chile, until now it is a cinch. Where it used to take a full-rigged ship three months to sail the necessary 14,000 miles forty years ago; and Yesterday express steamers shortened it to 5,000 miles in three weeks; Tomorrow you will be flying down to Chile in *three days.*

No. 2: CHILE

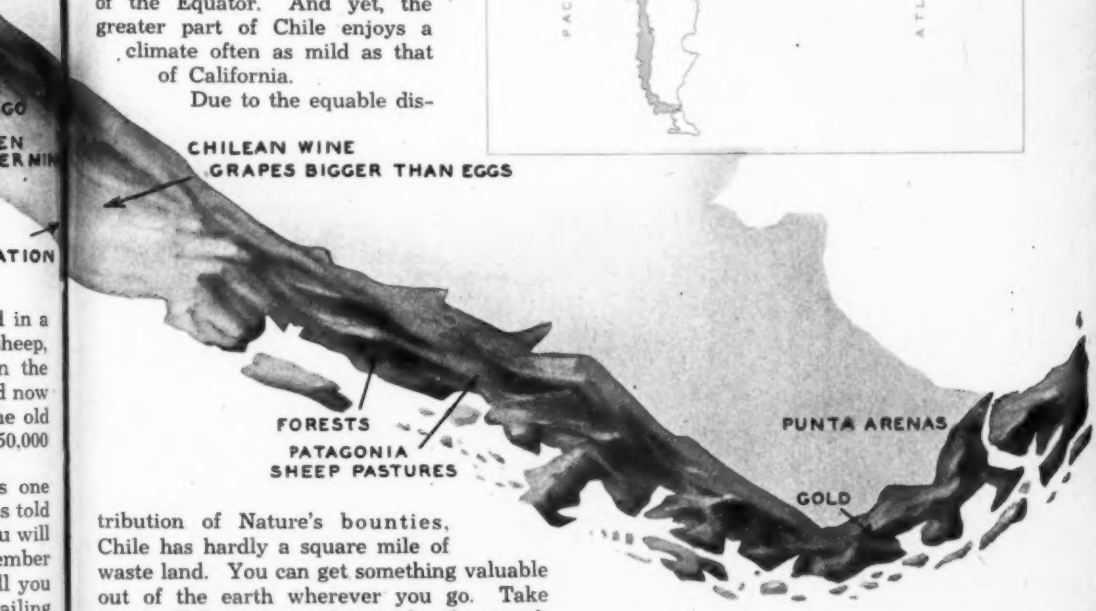
by

Henry Albert Phillips

Second in a series of articles taking you country by country through South America.

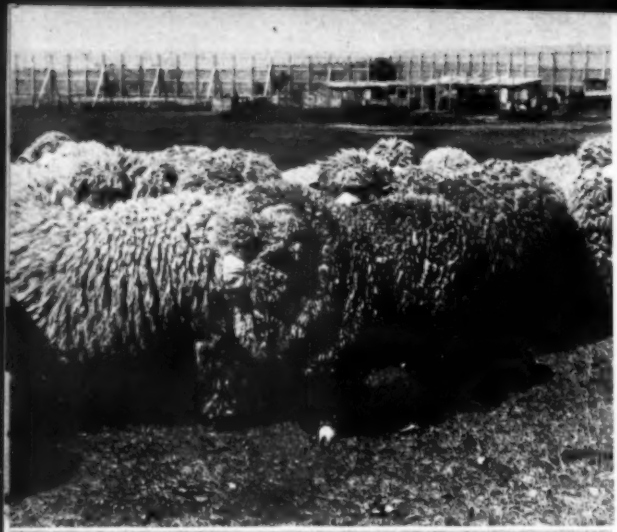
No other country in the world is so strangely formed as Chile—like a string bean. It is 160 miles longer than the United States is broad, with an average width of 125 miles. It stretches farther south than any other habitable land on the compass, almost to the Antarctic ice packs—and northward to within a few degrees of the Equator. And yet, the greater part of Chile enjoys a climate often as mild as that of California.

Due to the equable distribution of Nature's bounties, Chile has hardly a square mile of waste land. You can get something valuable out of the earth wherever you go. Take North Chile with its thousand-mile stretch that resembles the Arizona Desert. You would think the land wasn't worth a nickel an acre. Yet, in that sunbaked sand lies Chile's richest asset: nitrate.



Ninety per cent of the world supply of natural nitrate is found in Chile. In war, or in peace, Chilean nitrate is a lifesaver; like the world monopoly of iodine that is its by-product. In war it is the basis of all nitro-explosives. In peace, as the most potent fertilizer known, it will be in demand to vitaminize the worn out soil and give food to a starving world.

Since World War I, other countries have been manufacturing a synthetic nitrate, but they cannot get along without a per-



At Punta Arenas, the world's southernmost city, this New Zealand stock of sheep thrives. Wool is equal of the best.

A small hand operated copper mine just across the property line of Chuquicamata. Today those are golden Chilean shovels in the hands of these laborers.

centage of Chilean nitrate to mix with it.

There used to be 150 small concessionaires chipping away at the nitrate beds in a two-penny fashion. Then American capital came along and went into the field. It put $70,000,000 into the industry. American engineers invented a new process of converting nitrate. They scrapped the old-fashioned works and built a miracle industrial city to accommodate 25,000 people out in the middle of the desert and called it Santa Elena. For the next generation they will continue to work tooth and nail, with a capacity for two million tons a year. At the moment they are turning out 1,500,000 tons.

The nitrate fields are the residue of a sea that dried up ages ago. They cover a thousand square miles.

The story of Chilean copper is similar. Since Americans took the lead in its development, Chilean copper production has increased a hundred fold.

Only last year, Colonel William Braden—father of our Minister to Cuba—died in Reno, Nebraska. Before Braden went to Chile and struggled for years among the arid mountains, copper working had been conducted only on a small scale. It was due to the vision, grit and enterprise of men like Braden that deposits were uncovered showing Chile to be the second largest source of copper in the world. The Chuquicamata Mine is a mountain of copper.

Today the towns of Sewell and Chuquicamata are filling in a fatal gap made by the copper supply of the United Nations falling short of vital needs, some 200,000 tons a year. Chilean copper is more than saving the day and welding Victory.

Already a sensational move is in progress forecasting the brilliant future for Chilean copper. Two complete copper and steel plants in the United States have been knocked down and shipped in their entirety to Chile. Within the year that country will be turning out 30,000 tons of its own copper wire.

Chile is the chief mining country in South America. Eighty to 85 per cent of Chile's exports are of mineral products, with the United States as her best customer. But, as in the cases of all the other rich resources of South America, statistics tell only half the story. The far greater half of their treasures are still underground, as often as not undiscovered.

Iron deposits are reckoned at a billion tons. Coal at two billion. Sulphur in unmeasured quantity. There is so much desert salt and borax that it pays to export it. Oil seepages have appeared in many places, but no extensive drilling [*Continued on page* 152]

HELLO BOYS!

the world's greatest toy factory is fully enlisted for war production...*but toys from unrationed materials are still coming from the* GILBERT HALL of SCIENCE

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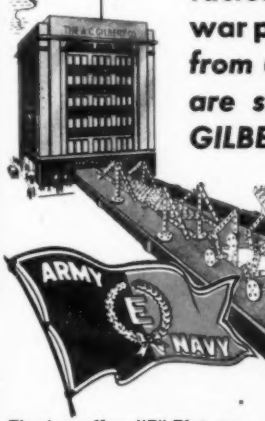
Because Uncle Sam needs metal for war, American Flyer Trains and Erector sets cannot be made this year. But perhaps you can think of some older boy in your neighborhood who had a set he has outgrown . . . and Dad can get that set for you this Christmas. Start your search *right now!* Also, visit your local toy store and ask to see other Gilbert Products.

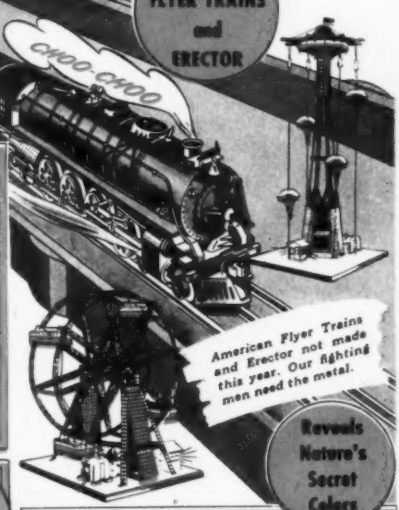
When in New York, visit the Gilbert Hall of Science—5th Ave. at 25th St



The Army-Navy "E" Flag, won by Gilbert workers for high achievement in war production.

ERECTOR JUNIOR builds big action models

AMERICAN FLYER TRAINS and ERECTOR



American Flyer Trains and Erector not made this year. Our fighting men need the metal.

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It's a snap to build thrilling action models with Erector Junior . . . bridges, cranes, airplane ride, dozens of others. Fascinating array of punched strips, wheels, axles and other exciting parts. Made of *wood*—like famous mosquito bomber. Parts fasten together with big, easy-to-grip pin-pegs. You don't need a screw-driver.

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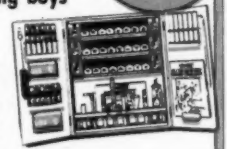

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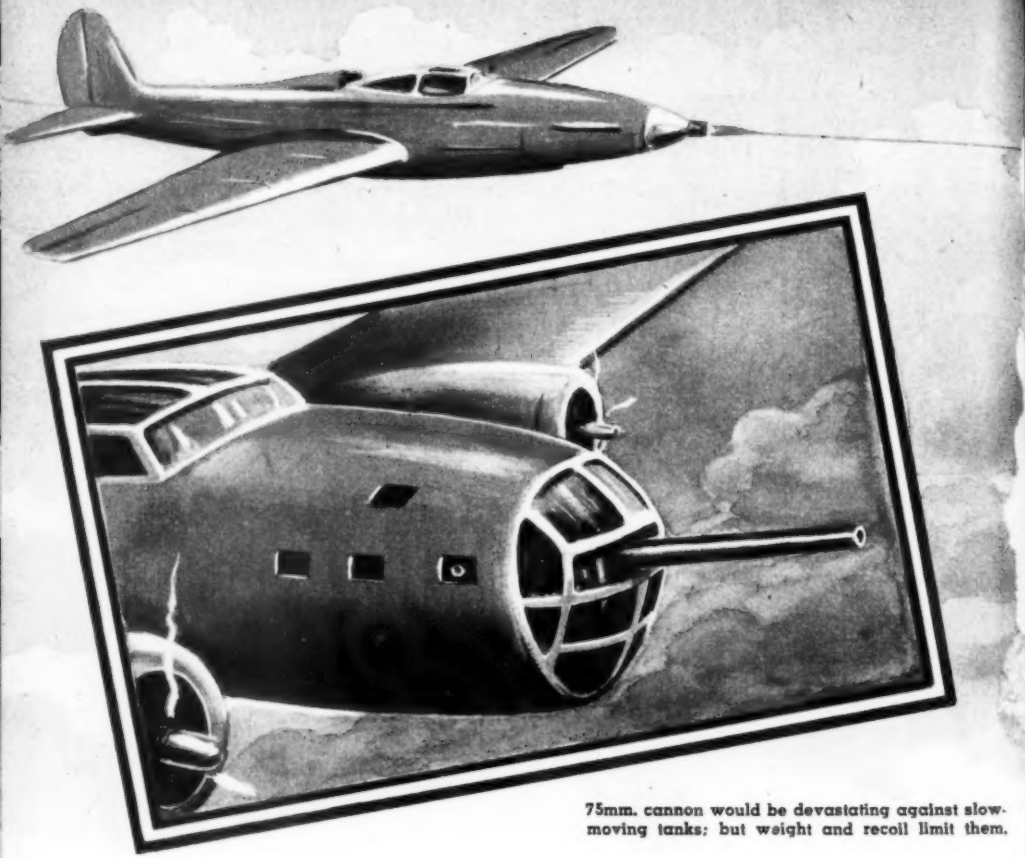


75mm. cannon would be devastating against slow-moving tanks; but weight and recoil limit them.

FLYING GUNS

by Willy Ley

I DON'T think that there exists any other war equipment which is in such a state of flux as the armament of fighter airplanes. Practically every fighter pilot has his own ideas of what he would like to have in shooting weapons. The designers are always open to suggestions; but they are suspicious and wary too and with good reasons. The more radical a proposed change in armament, the more far-reaching are the changes in the planes which are to carry that armament. And a radical change in armament also implies a radical change in tactics which, in turn, implies a different training.

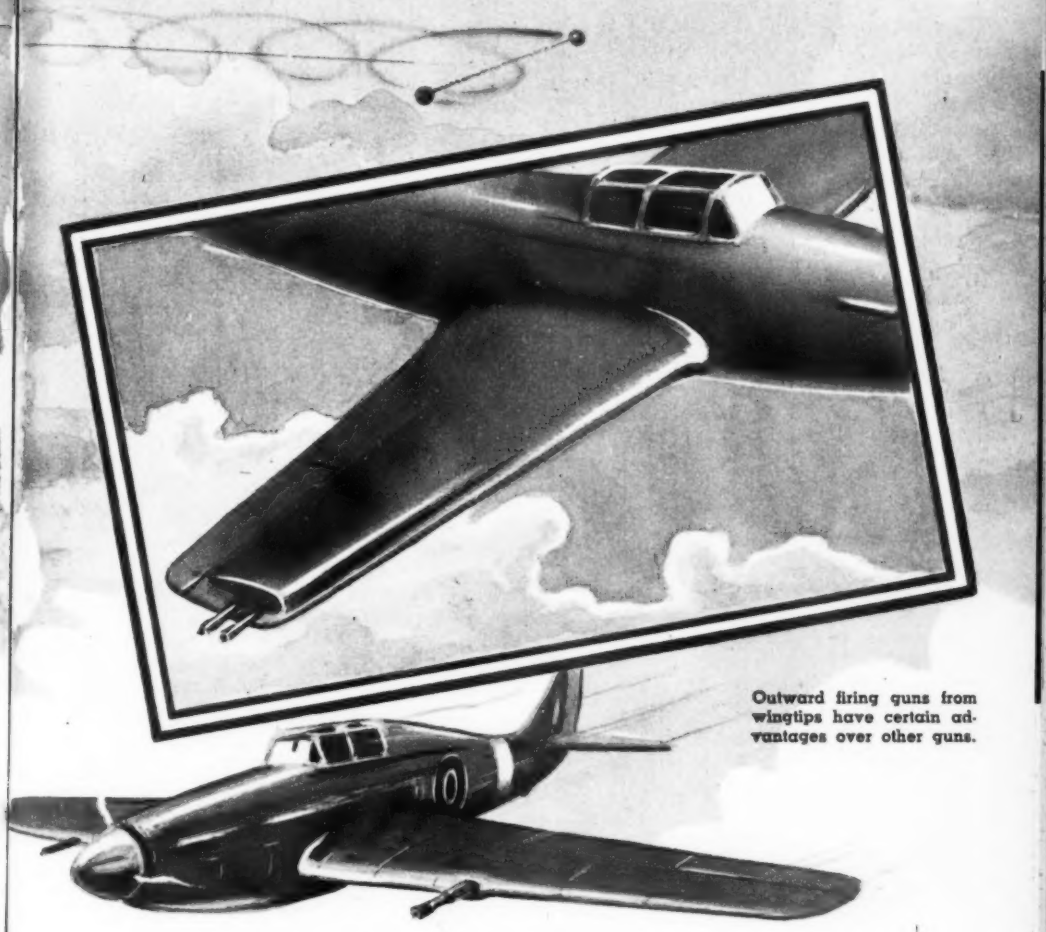
Neglecting all detail the problem, or problems, can be stated in the form of two questions:

(1) Is it more advisable to have the guns fixed rigidly or should they be mounted in movable power turrets?

(2) Is it preferable—provided that choice exists at all—to have one or two big guns or should it be a battery of smaller ones?

The answer to the first of these two questions has been given for the majority of the existing types in the following manner: bombers carry their guns in movable power turrets, while fighters carry their guns fixed

Chain-shot, like the South American bola, might be modernized to shear off wing and tail surfaces at close range.



Outward firing guns from wingtips have certain advantages over other guns.

The Hurricane's 40mm. cannon (above) are 3mms. heavier than the single nose cannon of our Airacobra which used to be tops.

in the wings, usually in such a manner that the streams of slugs from the machine guns converge to a point some 600 yards in front of the plane. But there are some types which do not follow that pattern, for example the turret equipped British Boulton-Paul Defiant.

As regards the second question the answer is not quite as clear cut. Many fighter plane types are going through a curiously weaving sort of evolution that progresses from some machine guns to more machine guns, to heavier machine guns, to fewer cannon instead of machine guns, to more heavy machine guns back again—with no definite answer in sight. The only consistent trend is a steady increase in fire power, in weight of shot and shell that can be fired per second.

Since fixed guns have been adopted to such a large extent for fighter planes it may be well to point out that this scheme is not without disadvantages. It is only the most efficient method so far, not an ideal solution. It is

the method where the disadvantages are the smallest and the advantages the largest. Generally speaking the design for fixed guns is simpler, the dead weight of turrets is eliminated and the gain converted into more and/or heavier guns, more ammunition, more protection for pilot and plane. Besides fixed guns can be operated by the pilot himself which saves the weight of the gunner.

But fixed guns require the aiming of the whole plane which results in acrobatics and shorter periods of fire since the target is in the sights for split seconds only. There is some advantage to these short periods of fire too, aside from the fact that the ammunition carried usually permits only about ten seconds of continuous fire from all guns. The point is that a machine gun is, after all, a stuttering rocket, exerting a recoil backwards with the tendency to stall the ship. And that recoil is large. For the latest model of the Hurricane it equals the pull of a 5,000 h.p. engine—if there were such a thing as a 5,000 h.p. engine.

The main disadvantages of fixed guns are, therefore, that they are awkward for ground strafing, that their recoil tends to stall the ship and that they necessitate aiming the whole plane.

The designers of the Boulton-Paul Defiant—now more or less obsolete—tried to avoid these disadvantages by installing a turret on the back of the fighter plane. It permitted ranging alongside an enemy while firing at him, but it added the weight of a turret and a gunner.

It might not be a bad idea to experiment with a fighter with fixed guns, operated by the pilot and located in the wings; but arranged in such a manner that they fire outward. This would combine some of the advantages of both turrets and fixed guns; it would not add any weight; it would permit ranging alongside the enemy and ground-strafing by flying at a tilt parallel to the ground—but it would, of course, require completely redesigned wings.

The Oerlikon 20mm. cannon shell. This is reproduced actual size.

So much for the position of the guns.

Now for the question of caliber which is the really difficult problem. At the present moment the .30 cal. machine gun seems to have been abandoned completely and has been replaced by the .50 cal. machine gun and by cannon. Many pilots prefer the .50 cal. machine gun to anything else for purely aerial combat. The heavy slugs of the .50 have not only a great power of penetration, they can also be used at a fairly long range, an even longer range, it seems, than some types of cannon. Recently the Germans introduced a 15 millimeter aerial cannon, apparently in an attempt to combine the advantages of exploding shell with the advantages of a .50 cal. machine gun. Their standard equipment used to be the 20 millimeter Borsig-Rheinmetall cannon. Whether that experiment will be successful or not remains to be seen.

The largest flying cannon definitely known to be in use is the 37mm. of the Airacobra, but a new type of British Hurricane carries 40mm. cannon. And there are persistent rumors about experiments with two- and even three-inch guns for aircraft.

The idea of the big gun airplane is by no means new. During the first World War the French ace Guynemer used a 37mm. Hispano-Suiza cannon in a specially designed Spad for a short time. The cannon fired through the propeller hub in very modern fashion and Guynemer is credited with having downed one or two German planes with this weapon. But it was a single shot cannon that could not be reloaded in the air and Guynemer soon returned to machine guns.

The whole problem, it seems, boils down to questions of weight (weight of the gun as well as weight of the ammunition) and recoil. While figures for the weight of the various weapons can be [*Continued on page* 156]

HOW TO BE AN ARMCHAIR STRATEGIST

by Col. Chalmer Hous

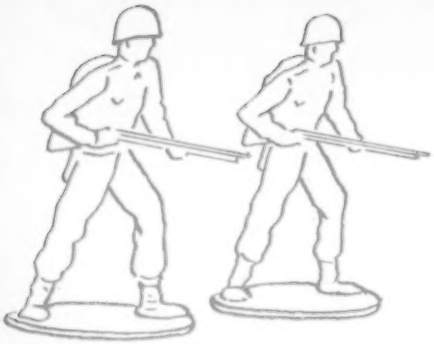
THE thrill of being a good armchair strategist can easily be yours. You can astonish your friends and influence people by the brilliancy of your strategical deductions. You can even convince wife or girl friend of the infallibility of your predictions to the point of having them proudly quote your dicta as the answer to all things strategical.

But to reach that proud pinnacle of success, you must lift yourself out of that large class of minor military mediums who set up shop on the sole basis of a few glib technical terms.

Foremost among the additional equipment required is a good map. It must be the right sort of a map.

Do not let yourself be beguiled by the purveyors of ordinary, one-dimensional, so-called "war" maps. They are a delusion and a snare. They bear as little relation to the essential verities of the terrain as a cardboard silhouette bears to the real Dorothy Lamour. Such flat chested maps leave out the most essential features, all the lithesome curves with which Nature so bountifully endows the earth and some of its creatures.

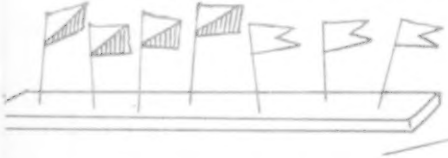
Heavy casualties among drawing room theoreticians are caused by maps which omit



all hint of valleys, plains and mountains. The shadowy armies of these one-dimensional military diviners (theirs not to reason why) are hurled into innumerable valleys of death, perilously marched over precipice after precipice, callously catapulted up totally unscalable cliffs and brutally mired in bottomless marshes, all through the inconsiderate use of maps that fail to show Nature's infinite variety of terrain.

The best map, of course, is the professional, military, contoured map. But as these are not easily available and take some skill in reading, the aspiring armchair augur can very well content himself with a good relief map, so well drawn as to disclose Nature's every curve and dimple to the most cursory eye.

While the war can be won by a smoking room strategist on only one map, the serious military seer will provide himself with several of larger scale, showing each combat area, plus a large over-all map portraying the entire global scene. It is in the selection of this larger over-all map that many a hopeful library Hannibal comes to grief by selecting our old school geography style of map. This shows the Western Hemisphere dominating the globe, with all the vast bulk of Europe, Asia and Africa as mere fringes. Geographically, this is slightly cockeyed, as the combined area of the other continents is far greater. Militarily it is also somewhat askew, as all the fighting areas are either on or contiguous to the European-Asiatic continental land mass. Naturally, the map must have a scale. A map without a scale is only a little more ornamental and just about as useful as a camera without a lense. A pair of inexpensive school dividers, to mark off distances on the map and compare them with the scale, will lessen the Herculean labors of our one-man General Staff. Map pins or ordinary pins with small, cut-out flags pasted upon them, plus some thin strips of colored cardboard or string to represent static military lines, will equip our dining room military dictator will all the armies, navies and air fleets he requires.



Keep in mind the speed and range of fighter and bomber planes and the marching speed of unmechanized and mechanized ground troops (modern, mechanized troops and armored units can average 30 miles a day in ordinary unopposed marching, can exceed these to 50 or 60 miles with smaller units in emergency; foot slogging troops can average 12 to 14 miles a day in ordinary marching but can force this up to 20 or 25 miles in emergency, for two or three days).

The armchair strategist must now look to his mental equipment. It will cheer him up to know that war, with the single exception of love, is the most simple and basic of all man's activities. The most skillful leaders can all be summed up in our own non-professional General Forrest's few words. This saddle-seat strategist said he'd trade any book on tactics in the world for five minutes of "bulge" (i.e. jump) on the enemy. He is most noted for his quoted "Git thar fustest with the mostest men," but one of his most laconic and revealing statements is little known. This was occasioned by a report from one of his lieutenants, stating that he was surrounded and outnumbered and asking what to do. Forrest scrawled on the back of the note "Godemitfitem!" Which comes close to being the essense of strategy. The main principle of war is the *offensive*—a minimum of sticking around waiting to be hit, and a maximum of boring in on the opponent's chin; *security*, guarding your own chin and solar plexus from a disabling blow; *mobility*, good fast footwork to carry the brawl to the opponent's corner; *concentration*, combining legs, loins, back, shoulders, arm and fist to give the other fellow all you've got in one wallop; *economy of force*, fending off the opponent's feints with the least amount of adequate effort in order to conserve your own striking power; *surprise*, hitting the other fellow where and when he least expects it; the *main objective*, in war not the taking of

villages or cities but the destruction of the enemy's main forces wherever they can be found on land, sea and in the air.

Keeping these things in mind, let's look at the war news.

To understand the complete pattern one must cease thinking of each area, the European, the Mediterranean or the South Pacific, as a separate war. They are all parts of one war. The war is actually centered around one vast area—the Eurasian land mass, the "World Island" so called.

Looking at a global map in this fashion, we see that the Axis dominates the three most approachable and vulnerable shores in this island, the European Atlantic Ocean and Mediterranean Sea shores, and the Asiatic shores of the Pacific Ocean.

Guarding these shores, as a protective screen, the Axis has established a great fleet of island outposts, stationary aircraft carriers and submarine tenders, extending from the Norwegian islands down through the Mediterranean to include Sardinia, Corsica, Crete and the Dodecanese—to the Andaman Islands in the Indian Ocean and around through the Pacific to include thousands of islands great and small, sweeping in a vast field from the northern tip of Australia to our own Aleutians.

We are taking the offensive against an entire continent—consisting of Asia and Europe. To simplify our problem fully, we must begin to look upon that entire continent, including Asia, as a great fortress.

Now, one does not start out by "invading" fortresses. One "reduces" a fortress by siege tactics.

All siege operations follow certain definite steps, whether that siege be of the ancient Assyrian fortress city of Ninevah far back in the earliest recorded history, or the huge fortress continent of Eurasia today.

These steps, some of them occurring simultaneously, follow roughly in the order named:

(1) Blockade.

(2) Circumvallation and bombardment. Circumvallation is the surrounding of the besieged enemy with strong lines to prevent his counterattack. Bombardment is the long range hurling of missiles to soften him up.

(3) The seizure of strong advanced posts suitable as bases from which to provide covering fire to protect the assault.

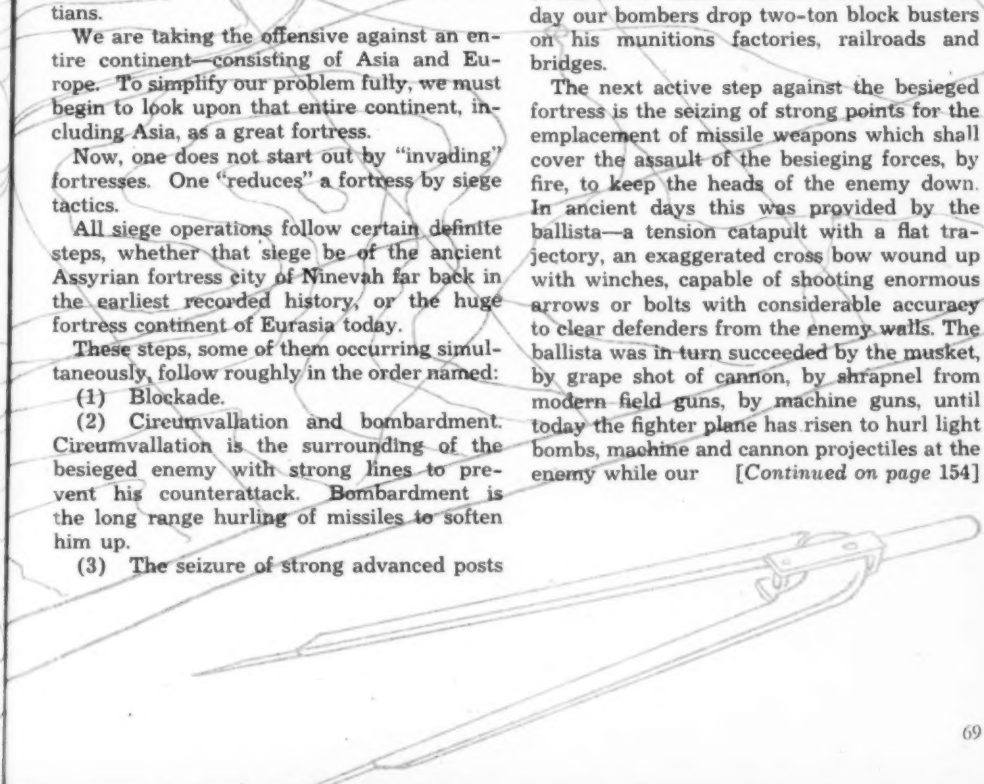
(4) Effort to disperse the enemy strength before the assault, by (a) threatening assaults from several different sectors to secure outer dispersion, and (b) by fomenting uprisings, mutinies and sabotage from within to achieve inner dispersion.

The real assault is generally launched simultaneously from two or more directions in combination with feinting assaults, when maximum enemy dispersion has been achieved both from without and within, and when enemy food, weapons and morale have been sufficiently depleted from blockade and bombardment.

The besieging forces, after driving in the defenders outlying detachments, next establish the line of circumvallation, as it is called, to prevent the besieged forces from making sallies in force or breaking out in counterattacks. Our occupation of North Africa was one part of this phase of siege operations.

The first of the active steps is bombardment. This serves a dual purpose. In the ancient days catapults propelled rocks and dead horses, by high angle fire, into the enemy houses and streets to interfere with the work of his arrow makers and sword smiths. Today our bombers drop two-ton block busters on his munitions factories, railroads and bridges.

The next active step against the besieged fortress is the seizing of strong points for the emplacement of missile weapons which shall cover the assault of the besieging forces, by fire, to keep the heads of the enemy down. In ancient days this was provided by the ballista—a tension catapult with a flat trajectory, an exaggerated cross bow wound up with winches, capable of shooting enormous arrows or bolts with considerable accuracy to clear defenders from the enemy walls. The ballista was in turn succeeded by the musket, by grape shot of cannon, by shrapnel from modern field guns, by machine guns, until today the fighter plane has risen to hurl light bombs, machine and cannon projectiles at the enemy while our [*Continued on page* 154]



WIN THE WAR AT HOME

BY W. H. FAWCETT, JR.

PRESIDENT OF MECHANIX ILLUSTRATED

OUR government is asking every family in the United States to join in the battle to wipe out the Black Markets and a rising cost in living. To do this the Office of Price Administration asks that this pledge be made and kept:

I will pay no more than top legal prices.

I will accept no rationed goods without giving up ration stamps.

The OPA is charged with the responsibility of setting up price controls and to see that everybody gets a fair share of essential commodities, but the agency cannot do the job alone. It must have the active co-operation of the American people.

The pledge campaign is to be carried on in every community and the drive will continue through the end of 1943. Each pledger will receive a window sticker symbolizing the fight against Black Market chiselers.

These are the steps pledgers agree to take to support the price control and rationing program:

1. Make the Home Front Pledge.

2. Display the symbol in a window.

3. Watch for publication of top legal food prices in local newspapers.

4. Clip out the official lists and carry them on all shopping trips.

5. If the lists are not published in the newspapers, obtain them from the local War Price and Rationing Board.

6. Check retailers' selling prices to see they are no higher than the top legal prices.

7. If the retail prices are too high, talk to the storekeeper about them. The honest retailer will check up promptly, for it is a protection to him against dishonest dealers to see that his prices are right.

8. If the retailer is unwilling to correct his error, report the violation to the Price Panel of the local Rationing Board—in writing. (Names of those who report never are used without permission.)

—★—

All sections of the country have reported excellent results from respective tin can salvage drives, but unfortunately there have been instances where drives have been retarded either through ignorance or carelessness. The handicap has resulted from people failing to clean the cans thoroughly before mashing them flat. These cans frequently cause more damage than good and actually hinder the salvage effort. The unwashed cans are particularly detrimental because decayed food pollutes chemical solutions used in the detinning process. This causes a waste of scarce chemicals and burdens the entire detinning job. So in the future, don't toss in a can unless it is clean.

—★—

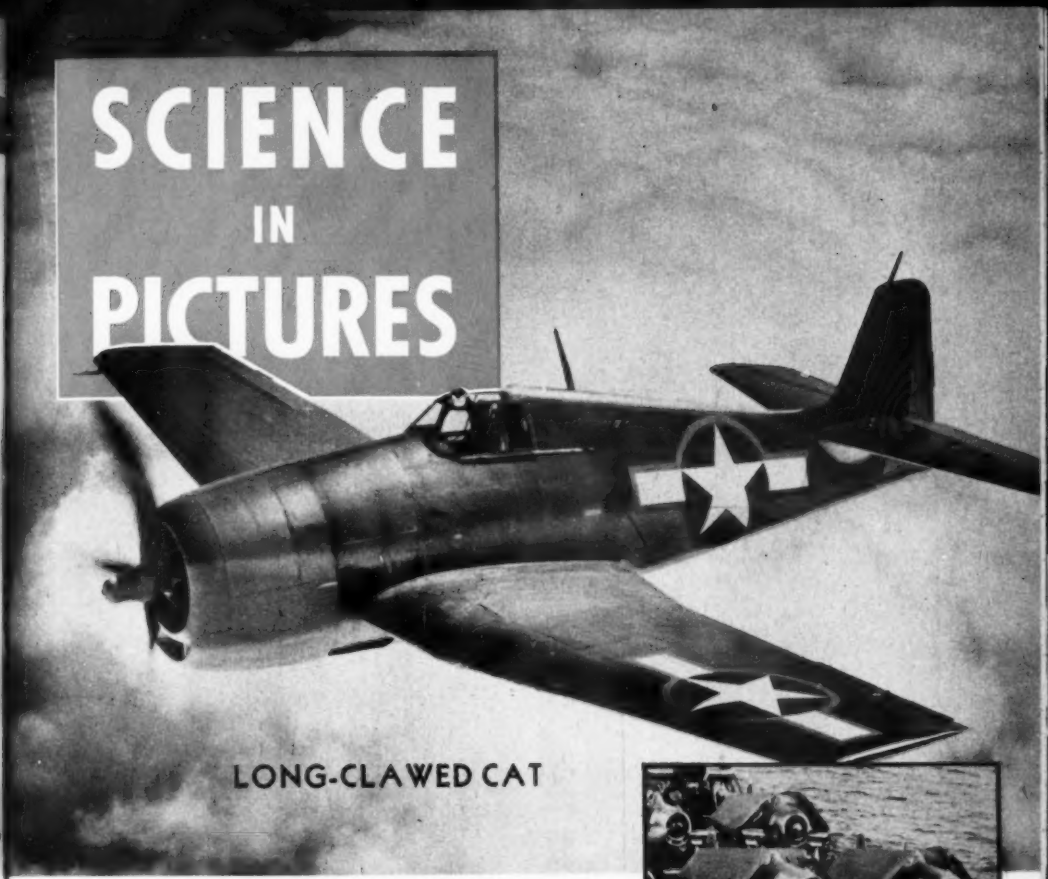
Should your hardware store man deliver your purchase from his store and also bring along your groceries and meat, don't be surprised—that's what the government calls the Share-The-Truck plan. It's being encouraged in all small communities. When the grocer brings your meat as well as groceries in his truck on Tuesday, and when the butcher's truck arrives on Thursday with groceries as well as meat; it means they are saving truck mileage. It may sound odd but it makes sense when you realize there are nearly 5,000,000 trucks in America. If each one saves a mile that's 5,000,000 miles added to the potential life of wartime truck transportation. It conserves rubber, gasoline, manpower. Truck-sharing in small communities by millions of one-truck operators will mean millions of truck miles saved. Also remember we all can help by continuing to carry our own small purchases.

—★—

The mile you ride today may be the mile you will have to walk next year. A war worker's car is only as good as its weakest tire. If the American workers are to continue producing weapons to be rushed to our soldiers at the front, they must use their cars in such a way as to make them last the longest. Your government urges you to form Car Sharing Clubs. Hitler rides in the empty seat.

W. H. Fawcett, Jr.

SCIENCE IN PICTURES

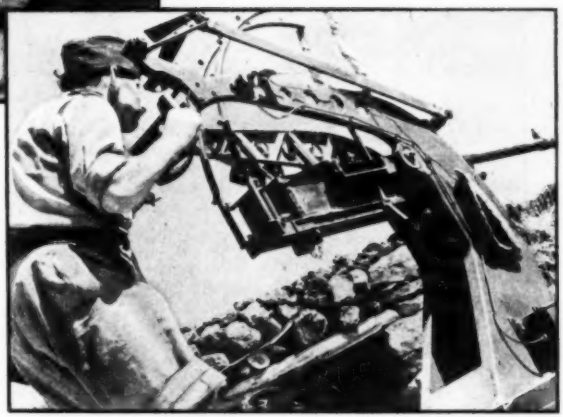


LONG-CLAWED CAT

THE F6F Grumman Hellcat, U. S. Navy's latest fighter. It's the fastest, most maneuverable, longest ranged Navy scrapper. First action was against the Japs at Marcus Island. A super-powerful warplane, the Hellcat (like its predecessor the Wildcat) has the Grumman folding wing which increases fighting complement of carriers (right). Note its size in comparison with pilot (below). Stability makes this all-altitude fighter a great gun platform.

No Liferaft? Rest And Be Shockproof Anyway

THIS lifesaving jacket of the Royal Canadian Navy developed by Lieut.-Commander Tullidge and Lieut. Cowan will float a man indefinitely. It protects him from underwater blasts and provides him with a whistle and a light. There's even a pillow for comfort. A snap-hook can be attached to the life lines of Carley floats and web handles are for the purpose of lifting a man out of oil and debris covered water. Chest and stomach are doubly protected. Canadian seamen will also wear a bright orange cap that can be spotted easily by rescuers. Lieut.-Commander Tullidge gives it last inspection.

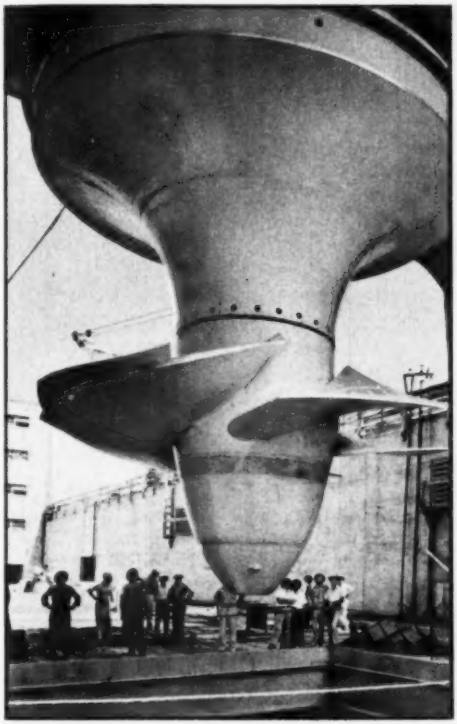


Sick Sicilian Ack-Ack

AN R.A.F. officer tries out a Breda cannon previously used by Italians as ground ack-ack on Biscari airfield, Sicily. In spite of intensive "ploughing up" operations by the retreating enemy, captured airfields were put into service in a very short time, and guns like these responded favorably to treatment.

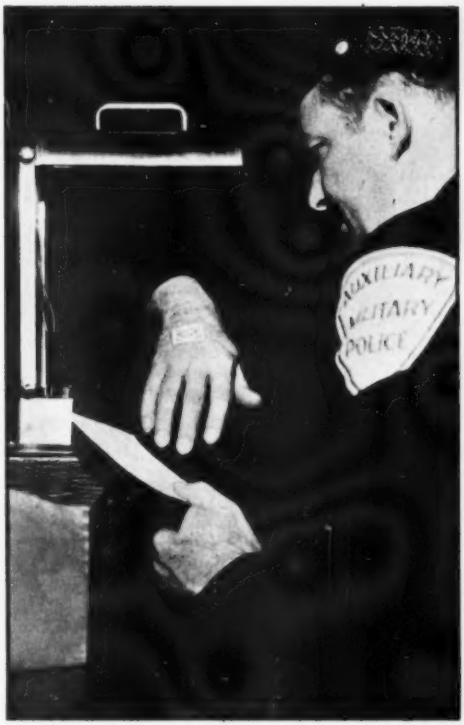
Wise Scientist Of Poison

THE strange hobby of Dr. William J. Bonisteel, professor of botany and pharmacognosy (the science of basic medical materials) at Fordham University, is making poisonous plants more poisonous. By hybridizing and chemically treating deadly plants he increases their percentage yield of poison. A Borgia? Hardly. His purpose is to develop alkaloids that may allay otherwise insufferable pain and sometimes save life. Here is same plant treated differently.



By The Old Mill Stream

ENGINEERS call it the "turbine runner." It's a 218 ton waterwheel that will drive the first generator at TVA's Ft. Loudoun Dam powerhouse at exactly 105.8 revolutions per minute. The runner will develop 44,000 horsepower and the generator to which it will be attached 32,000 kilowatts of electricity.

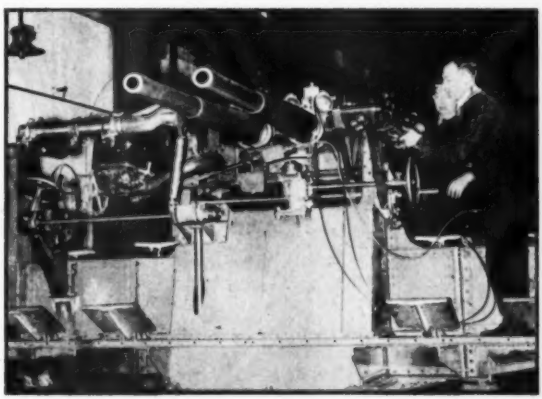


To Check War Workers

A NEW and positive method of identification of war plant workers by means of an invisible chemical and ultra-violet ray "black light" is announced by Sun-Kraft, Inc., Chicago. The symbol on the worker's hand is not visible except under the special lamp and is known only to the plant guards.

Waiting For "Fritzie"

THE Nazis stayed away from somewhere in Britain; but this anti-invasion gun waits hungrily. The twin six-pounder rests delicately on its powerful machinery while workers in a Ministry of Supply ordnance factory align it in horizontal. No doubt this dissuader will know more polish than action, but its perfect black eyes remain two more efficient watchers for anything unwanted that may slip out of the Hitlerian fortress. Maybe the Nazis guessed they'd be seeing double.

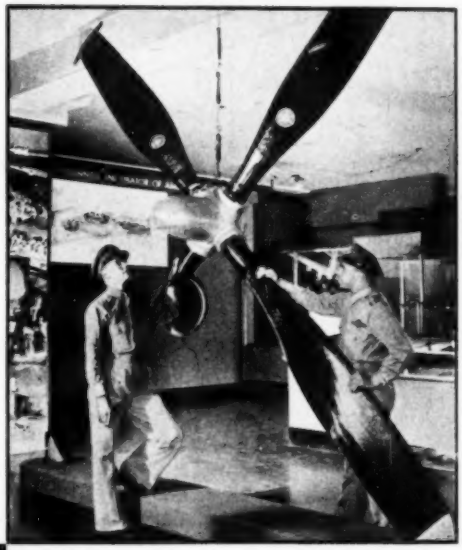


One Week River Jitney

THE Army's new portable tug chugs up the Potomac. The vessel is all steel and is powered by two gasoline engines. It takes seven days to build, can be dismantled and put together again in three hours. Army officers, having dubbed it "river jitney," say it is more maneuverable than an ordinary tug.

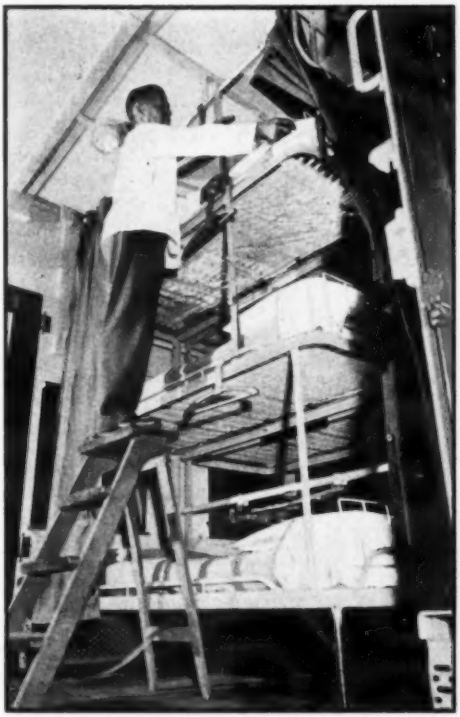
Largest Four-blader

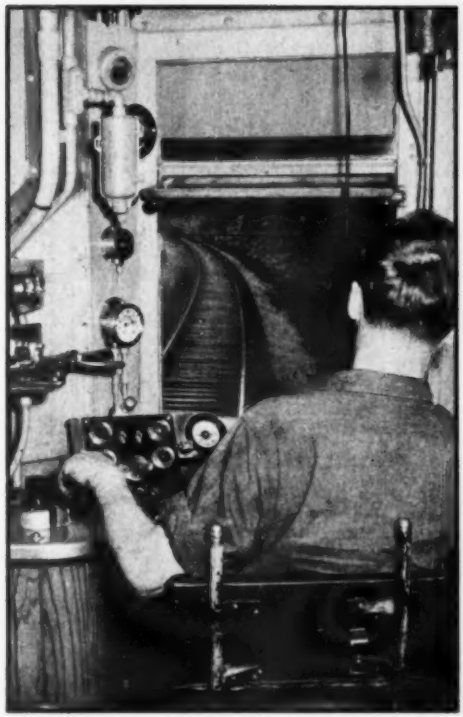
A MERE 16 feet 8 inches in diameter and weighing approximately 800 lbs., this Curtiss-Wright Corp. propeller is the largest four-bladed warplane puller on earth. A hollow steel type, it's for use on multi-engined sky dreadnaughts of the future. South African Air Force vets inspect it.



Wave Machine, Non-permanent

HOLLYWOOD beats 'em all, including Mohammed. The movies can't go to the ocean because of wartime restrictions so the ocean comes to the movies. In the studio this machine creates waves and colors for sea pictures. Looking somewhat like an electrical bread mixer it projects clouds and sea-in-motion so realistically that cast and crew often complain of seasickness. It makes a stationary ship on a stage seem to be pitching and rolling in waves.





Soldier Sleepers

A NEW type of Pullman car designed for transportation of service men is the first of 1,200 new sleepers incorporating a special triple-deck berth arrangement, instead of the usual upper and lower. The entrance is in the middle. The cost is only a fraction of the price of a standard Pullman car. Your old friend, the porter, makes up the top berth of the tri-bed carrier of the finest fightin' men being transported on this earth.

Railroad G-Men

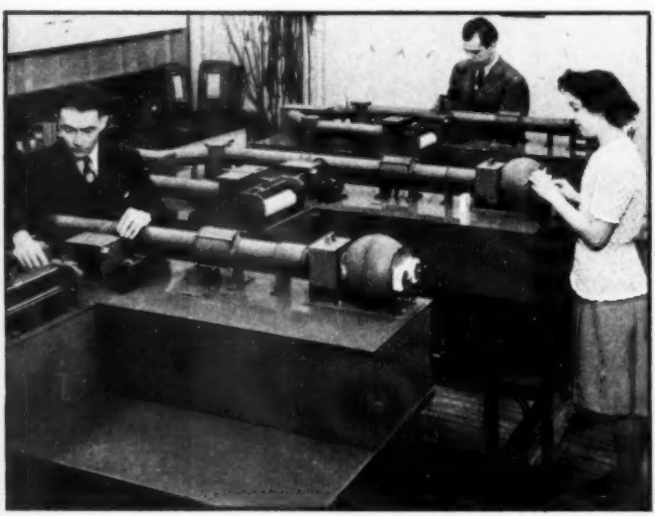
THE Sperry Detector Car. Above top, an adjustment is made on brush carriage, which charges the rail with current, on the new car to end train wrecks. Any flaw in rails is automatically detected and white paint shot on it by paint gun (extreme left of brush carriage). Immediately above, driver is shown at controls of the "train's best friend" as it moves along the rails in a testing operation of wartime overburdened railroads.

Stratosphere To Hell

THE supercharger impeller, being secured to shaft (at left) in General Electric's Ft. Wayne plant, is exposed to temperatures as low as 67 degrees below zero when fighting bombers soar into the stratosphere, while the turbine wheel (on the right end of the same shaft and but 18 inches away) is driven by the hot exhaust gases from the airplane engine at a temperature of 1,500 degrees above zero. Both revolve at speeds of more than 20,000 r.p.m. with clearances to the millionth of an inch. Temperature, when necessary, can be made meaningless by modern methods of precision manufacturing, war having asked so much of metallurgy. The production-line soldier is Miss Eva Morrolf.

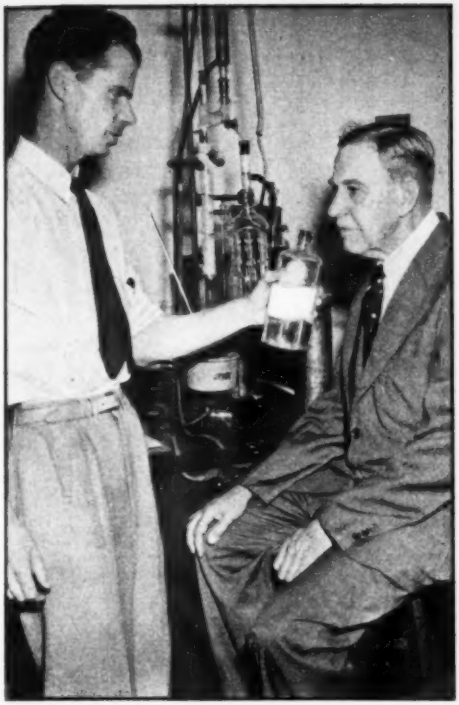
The Deadly "Bishop"

THIS self-propelled killer is known as the "Bishop" in the Middle East. A deadly gun-tank combination, it contributed heavily to the Allied victories in North Africa. Now it has added to its blasting record by ambling over the mountainous country of Sicily. The gun is mounted on a Valentine tank chassis. This particular "Bishop" rests on Sicilian soil.



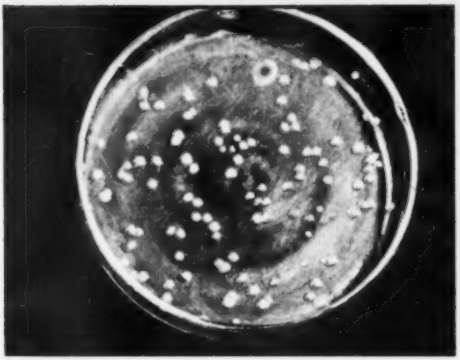
Cramping The Style Of Enemy Cameras

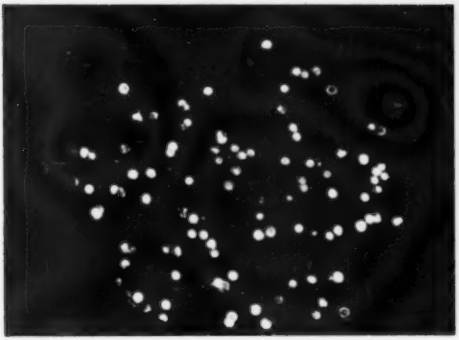
CAMOUFLAGING suffered a major setback when the infra-red camera was developed. Infra-red light, not visible to the human eye, can be photographed. Thus two objects, having same color to the eye, may photograph differently. The camouflage artist cannot judge how a color will look to the camera. But General Electric's recording spectrophotometer matches colors to fool the camera.



Superdupergas

IN THIS plain bottle is the powerfully efficient new gas that will alter radically the peace-time engines to come. Dr. Haensel (left) and Prof. Impatieff inspect the finished product. Haensel is an M.I.T. man. Impatieff once headed Russia's chemical industry.





Luminous Bacteria

CAPTURED on Petri plate shown at top are cultures of luminous bacteria being used by Westinghouse research men to study best methods of preventing spread of disease in offices and shops. Below are same bacteria photographed by their own light.

Faster Than The Speed Of Sound

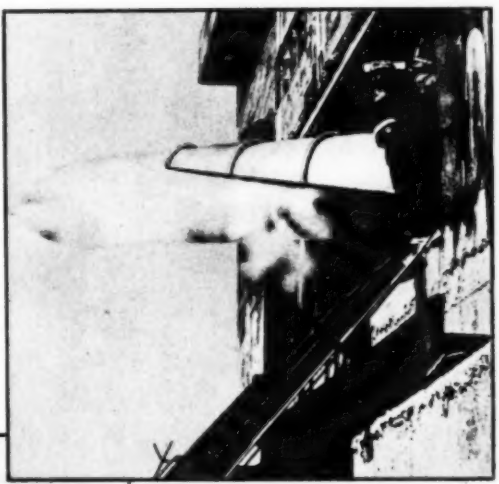
HERE'S the famous fightin' pair of planes, the Lightning and the Thunderbolt, with the man who raced Sound and left it behind. He's Lt. Col. Cass S. Hough (center). The mechanics that serviced the planes are S/Sgt. Carl R. Olsen (right), mechanic for the Lightning, and S/Sgt. Eliseo Borrego, who serviced the Thunderbolt. Speed? Over 780 m.p.h. Say, is that a horse and buggy going by?

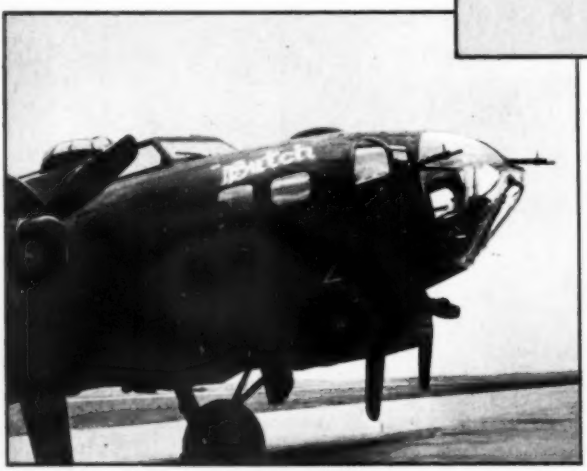
Behemoth Of Our Army Engineers

THIS is the largest single piece of equipment used by the U. S. Army Engineers. When an enemy air field has been captured and a resurfacing job is in order, in rolls this giant with about all the equipment on it that is usually found in a contractor's shed. With the soldier as a comparison for size, this road-builder's sweetest dream must be a nightmare to enemy efforts at airfield destruction. Rube Goldberg is really out on a limb from now on.

German Land Torpedo

TORPEDOES, accepted as either aerial or underwater weapons, are being experimented with by the Germans as a land weapon. Nazi military experts maintain they are better used as a land weapon. They have built special fortified posts along Europe's coastline, manned by torpedo experts along with artillerymen. Here, in a picture received through a neutral source, a torpedo is being fired from one of the new land defense posts. In terror? Have all of Hitler's offensive weapons taken to the defensive?



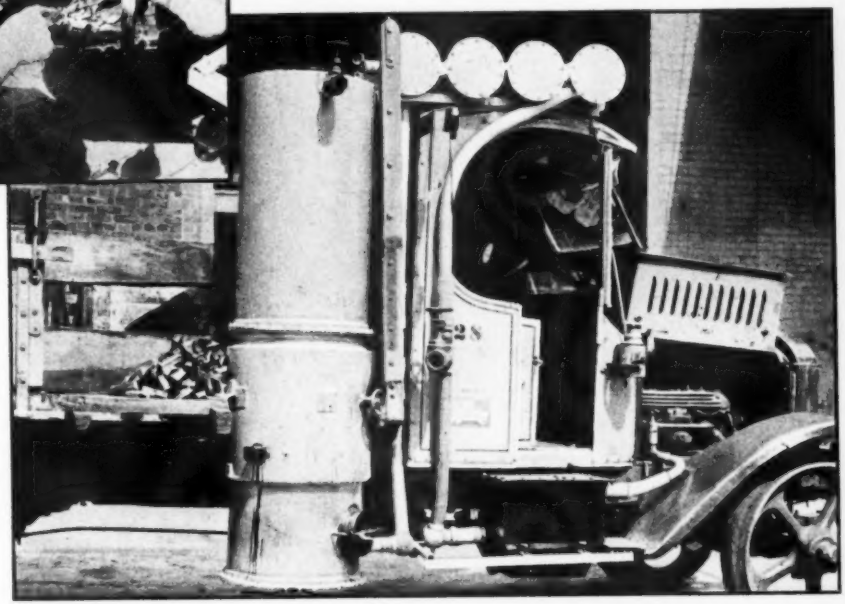


The New Fangs Of The Fortress

DESPERATE Nazi pilots recently developed the tactics of swooping in head-on to find a vulnerable spot in the Boeing Flying Fortress. These frontal gun positions are the special answer. In all, 13 guns defend the Fortress on her determined missions over Axis lands and sea approachments. New guns are .50 cal.

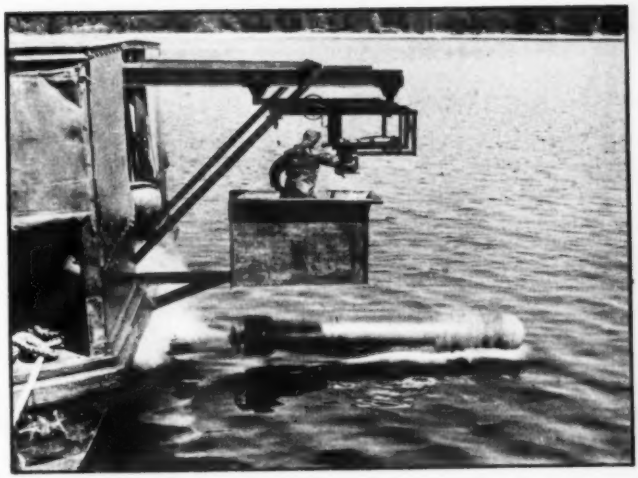
Wood Fuel Delivers Beer

THE Rheingold Brewery, New York City, has converted some of its trucks to use wood as fuel. Gas from burning wood is fed into the cylinders. The generator (left) fireplace-like gets a cleaning. On the truck shown below the generator tank (left), filtering tank (center) and cleaners and coolers on top are shown. With beer deliveries being such a problem for the thirsty, here is a note of cheer. Obviously these trucks should be more numerous and of far greater size.



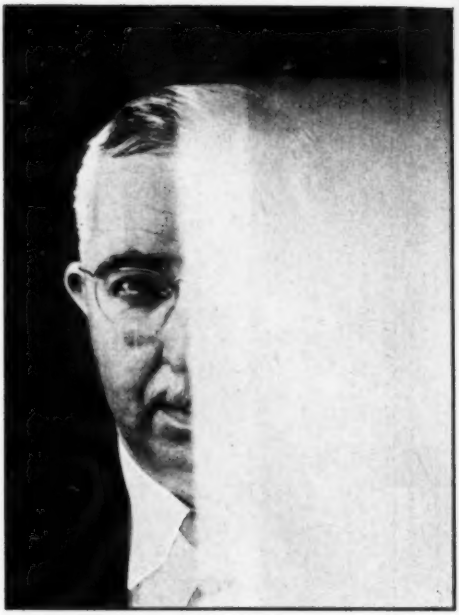
Sky Torpedo Water Tested

THAT horror of the Jap Navy, an aircraft-type torpedo, is tested at the Naval Torpedo Station, Keyport, Wash. The launching device, efficient and ingenious in itself, was constructed by Keyport mechanics from salvaged metal. With or without a war head, the tin fish is as functional as an overhand right to the chin. Observer's box seems to have cut clearance down pretty fine.



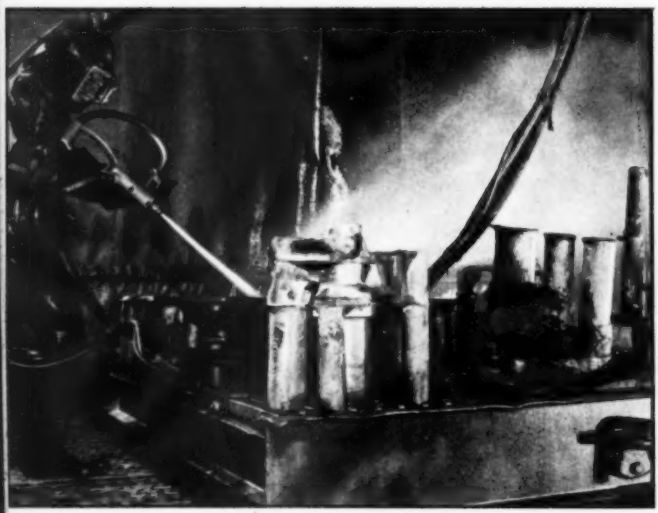
Little Man On Big Job

FIFTEEN years ago Clarence Kehr, Jr. mystified the medical world when on his third birthday he smoked cigars, lifted 200-pound weights, sang baritone. Premature physical development arrested his growth at four feet, two inches. Now he and his tiny wife do Jeep work others can't.



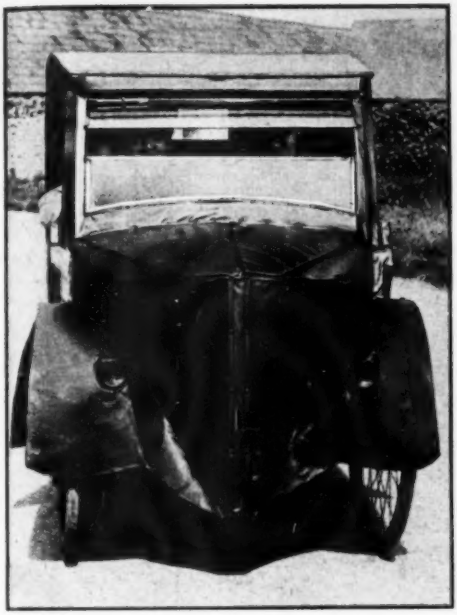
Non-Reflecting Glass

EVER have your auto windshield or eye glasses nearly blind you by light reflection? H. R. Moulton, research director of American Optical Co., is shown above with his specially treated glass. At left glass has been treated, at right it hasn't. Post-war windows, lenses, etc., will benefit.



Man From Mars

HERE is a worker in a Naval Gun Factory cleaning steel castings with a hydro-blast, a dangerous and difficult job. This is where big 16-inch rifles that thunder from U. S. battleships are produced by fine workmen from fine steel; where eight- and six-inch guns are built for heavy and light cruisers and the deadly five-inch dual purpose guns are turned out to protect U. S. warships against air and surface craft alike. The hydro-blast is but one of the complex operations in big gun making.



Three Bicycle Car

A GASLESS gadabout made mostly from three bicycles has two wheels in front and three behind. The wood from which the foundation of the hood was made was once a tea chest. The car has a fabric body and a gas pipe steering wheel. Designed by J. B. Hanson of Oxford, England.

Marvel Recorder

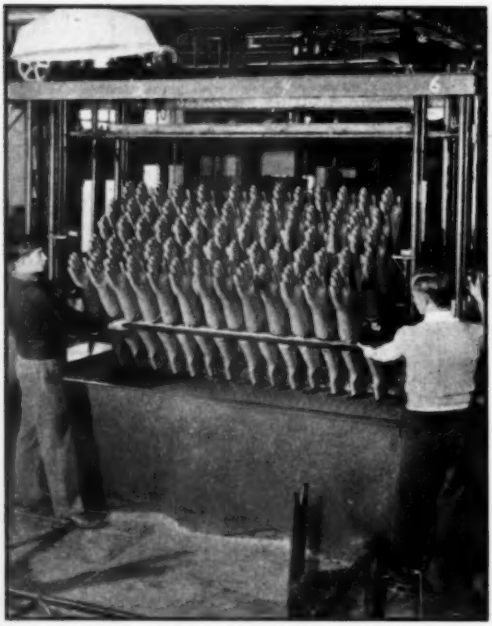
MARVIN CAMRAS with his new type of machine that records sound on steel wire as thin as human hair by magnetizing the wire. An eight hour program can be recorded and played back at once. The wire retains the sound for years or can be demagnetized immediately for fresh use.

If She Cares

HOW much faster does a girl's pulse beat when she thinks of her beau in the Air Corps? General Electric's photoelectric recorder tells when Arlene Veith of the Company's Engineering Laboratory, her finger in a receptacle linked to the machine, takes a look at a picture of her beau. Sensitive enough to record full scale on a millionth of a millionth of a watt of electrical power, the recorder has an unlimited number of applications for measuring delicate currents, physical, electrical or chemical. Next?

Tough Warplane Engine Cylinder

BACK from the Pacific attack via Pearl Harbor, this bullet-riddled Wright Cyclone 14 engine came to prove the toughness of American-made warplane engines. It's the type used in the Navy's TBF Avenger (torpedo bomber) as well as the B-25 Mitchell bomber (Tokyo raiders). As this Wright Aeronautical worker points out, an enemy .50 cal. bullet completely pierced the cylinder barrel and spent its force inside. The engine kept on operating after the cylinder was punctured.

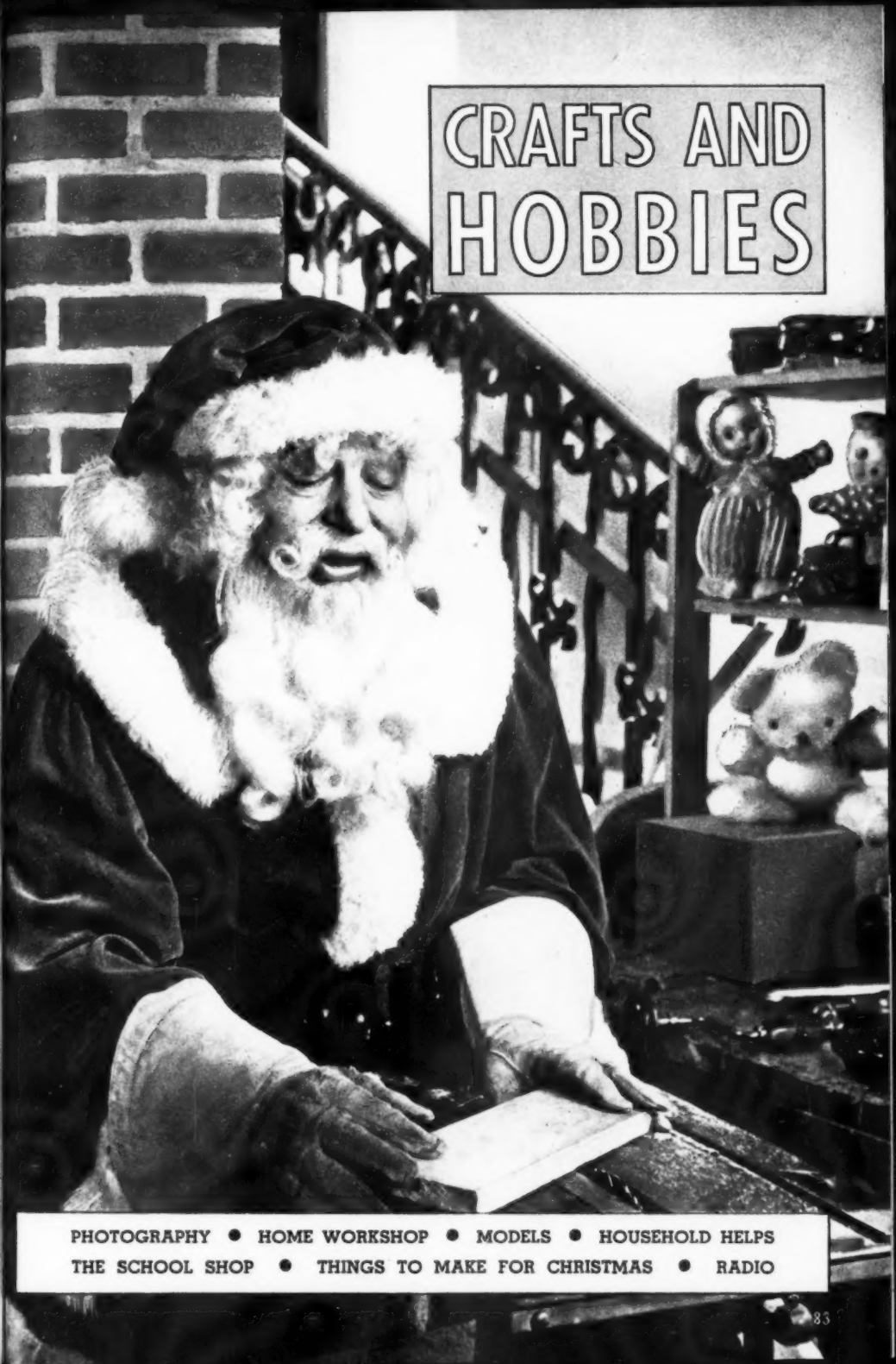


Shake Hands With Gas

A NEW application of synthetic rubber is in the manufacture of anti-vesicant gloves for use by decontamination squads in chemical warfare. These gloves, dipped in Neoprene, are impervious to mustard gas, are being made by the U. S. Rubber Co.

Subchaser Bearing

ANOTHER and better replacement for rubber, metal or wood is Westinghouse's Micarta, the plastic used for Army helmet liners. Now it goes into propeller shaft bearings. It enables submarine chasers and the like to stay longer on active duty.


CRAFTS AND HOBBIES
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"DODGING" WITH LIGHTS

by Louis Hochman

A few cardboard masks cut to shape and placed in front of your flood bulbs will eliminate stray light and soften undesirable shadows.

ONE of the nicest parts of indoor photography is the fact that you can exercise complete control over your lighting. You are at liberty to use as much watt-power as you desire and you can group your lights in whatever combinations suit your fancy. If you don't like the effects of one arrangement, you can change it to another, and if you want a couple of back lights added to your composition, you can toss those in, too.

Even though you have all this control at your finger tips, however, lights still can get out of hand and present difficulties if you are not very careful with them. For instance, when you direct the light of a flood bulb on your subject and manipulate it until you have just the effect on him you desire, the effect on other objects in the room may not be so pleasant. Light leaves the bulb in an extremely wide angle, and although you can maneuver some of the rays to the spot you want lighted, the rest of the light rays will spread out of control and give undue brilliance to other less important areas, even causing shadows to fall within the picture space.

To overcome this, the common practice usually has been to do a lot of dodging and "burning in" in the darkroom when enlarging the negative; but why toil in the dark when you can do a better job by dodging with the lights when taking the picture? It's a lot easier, too! If a flood bulb threatens to upset the balance of lighting in a picture by spreading its rays to unwanted portions of the scene, you can hold back that light with a sheet of cardboard, cut to allow only the desired rays to pass.

For instance, if you want to illuminate only the head of an individual, cut a hole in a sheet of cardboard and set this up in front of the lamp so that the light passing

Photo 1 was taken with masked lights. In Photo 2 normal lighting produced an uninteresting effect.

through the hole will fall where you want it. The rest of the cardboard will act as a mask, holding back the excess light and keeping it from spreading out of bounds. Cardboard masks can be cut or torn to any required shape and, when placed before flood bulbs, offer spotlight effects without the harsh lighting. They also offer a more flexible lighting control.

Now, knowing how to hold back runaway light, the next question is when to hold it back and when to let it go! That question is answered best by analyzing your setup and determining what you are trying to say. Make that action your center of interest and give it the strongest illumination. Look around and see if any unimportant details are receiving too much light. Too many bright spots in a picture will vie for attention and cause distraction, so if you find any that are too prominently lighted, hold back the light from them by making suitable cardboard masks to act as shades. A good way to determine the shape in which to tear the cardboard mask is to check [*Continued on page* 134]

Photo 3 shows background shaded by masks. In Photo 4 normal lighting has caused a harsh shadow.

Photo at the left shows how hands are used to determine shape for mask. Mask in place is shown at the right.

Vignetting portraits is simple with this mask.

VARIABLE VIGNETTER

by Victor H. Wasson

HERE'S a little gadget you can make in jig time and it will solve completely all your vignetting problems. No longer will you have to litter your darkroom floor with bits of paper and cardboard torn from improvised masks which never seem to act quite the way they should. A variable vignetter which can be adjusted to almost any shape and size is lying discarded in your home workshop, just waiting to be assembled and used.

The plates from an old radio condenser do the trick. If your cellar doesn't boast of an old condenser, surely a friend's does, but in any event a broken one can be bought from a radio junk shop for less than a quarter.

Eight plates are pulled from the rotating shaft of the condenser as shown. They will be found to come free quite easily. Another method to loosen them is to direct the flame of a small torch against the base of each plate to melt the solder which holds it in place.

These plates are smoothed with a fine file, and a ⅛" hole is drilled near one end of each. The eight plates are then clamped together in a stack and all drilled at once so as to insure having all the holes exactly in line.

Use eight plates from an old radio condenser.

Here is the variable vignetter, ready for use.

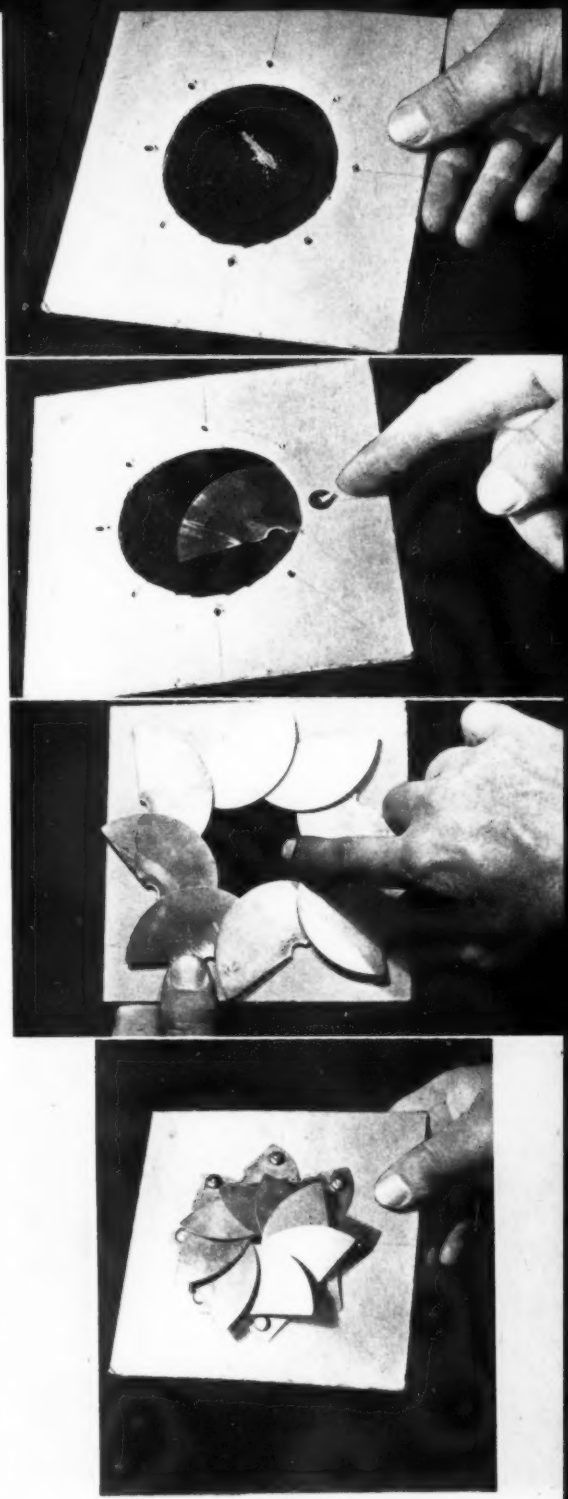
They should look like those in the photo.

The plates are mounted at equal distances around a 3½" hole in a card 7"x7" or larger, the card size depending upon your preference. Holes to receive the fasteners that hold the plates are punched at regular intervals ½" from the edge of the opening. Paper fasteners are pushed through the holes in the plates and cardboard.

Each fastener comes through to the other side and is bent through the washer which comes with it. It may then be tapped down tight enough to prevent the plate from moving too freely.

One plate is fastened in each of the holes, each plate facing the same way in such a manner that each overlaps the next as in the photo. Notice the completed vignetter in a closed position. The plates may be pushed back to enlarge the opening, and by adjusting one plate in relation to another, a great variety of shapes and sizes is possible.

A small investment of time in this one item will be found to save minutes and temper in a busy darkroom. Try it!



Cut a hole in a piece of cardboard and fasten the condenser plates around this opening as shown in the photos at the right. Use paper fasteners.

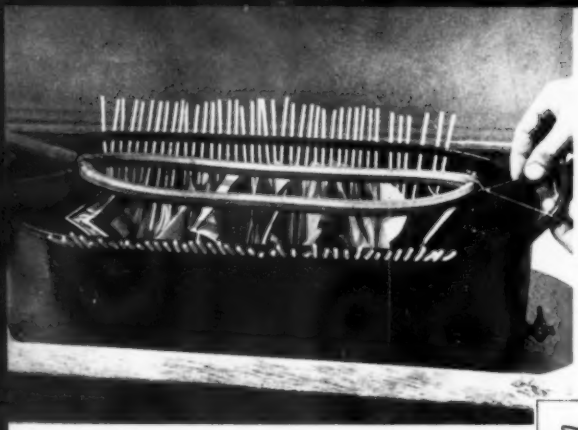
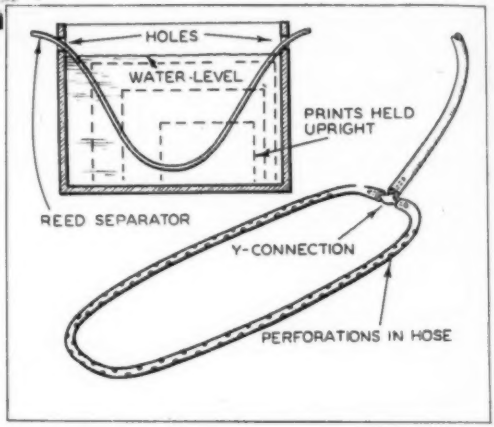
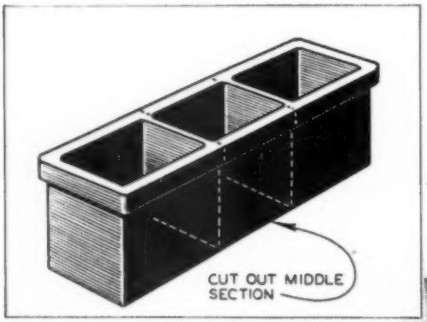


PHOTO KINKS

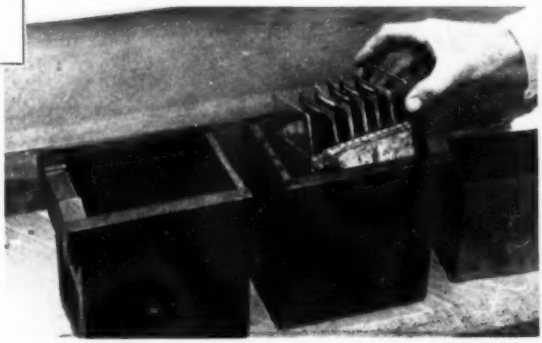
by J. Modroch

DRIP-TYPE PRINT WASHER: For the tank use a metal pan or wooden box. Water enters from dripping hose ring and drains through the pet cocks at each end near the bottom. Reed separators hold the prints upright as shown.





DEVELOPING TANK: If you can obtain a new battery case of the long type at a repair shop, the two end compartments cut off with a hacksaw will make excellent tanks.



NEGATIVE ADAPTER FOR LARGE CAMERAS: Cut-film sheaths, cemented to pieces of stiff cardboard of plate size and inserted in plate holders will enable you to use small film in your view camera (below).

PHOTO CONTEST

FIRST PRIZE ($10.00): Wonder If . . . ? by Karl Rosenberg, Canton, Ohio, taken with a Rolleiflex. SECOND PRIZE ($5.00): Prima Donna, by C. W. Myers, Dayton, Ohio, taken with a Voightlander Avus. THIRD PRIZE ($4.00): A Good Opening, by Louise P. Dodge, Ford Cliff, Pa., taken with an Argus C-2. FOURTH PRIZE ($3.00): Calling Me? by Gladys Diesing, Long Beach, Cal., taken with a Recomar.

1st PRIZE

2nd PRIZE

3rd PRIZE

4th PRIZE

Submit prints for this month's contest unmounted—no larger than 8x10 inches. With each print list your camera, film, lens opening and shutter speed, illumination, and developer. Write your full NAME and ADDRESS on the back of each print, and wrap securely with cardboard or corrugated stiffeners. If you want unused prints returned, YOU MUST ENCLOSE RETURN POSTAGE. (Published prints cannot be returned.) Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, N. Y.

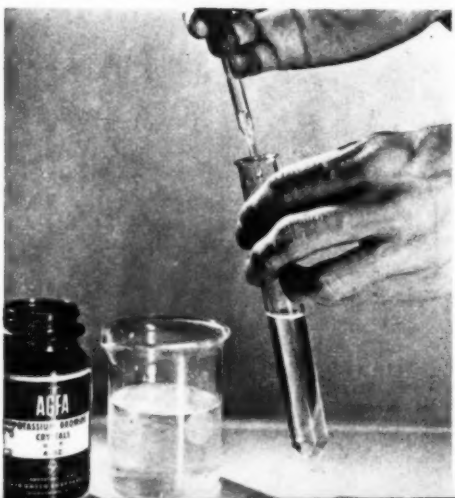
SIMPLE CHEMICAL EXPERIMENTS
ILLUSTRATE INDUSTRIAL PROCESSES

ALCOHOL from potatoes, corn and surplus grain; bromine from the sea; sweet-smelling flavors from alcohol and acid; formaldehyde from wood alcohol,—these are just a few of the amazing transformations being accomplished by our modern chemists. With only a few test tubes, an alcohol lamp or Bunsen burner, and several simple chemicals, you can demonstrate the fundamentals of these processes in your home.

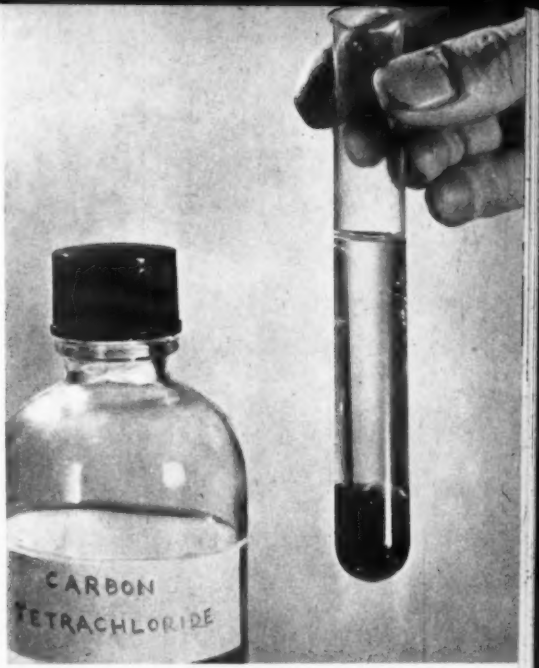
To make alcohol, boil some mashed corn or potato for several minutes to extract starch. Change starch to sugar by adding dilute sulphuric acid and heating solution for ten minutes longer. When cool, add yeast cake and let stand for several days. Yeast changes sugar to alcohol by a very mysterious process, liberating carbon dioxide which causes foam (right).

Bromine is used in making tetraethyl lead. To show how chlorine separates it from sea water, add chlorine water to weak potassium bromide solution (below). Brown color indicates the presence of free bromine.

Dissolve some potassium dichromate in water and add a few drops of sulphuric acid and some of the fermented solution. Change of color from orange to light green is proof that alcohol is present (above).

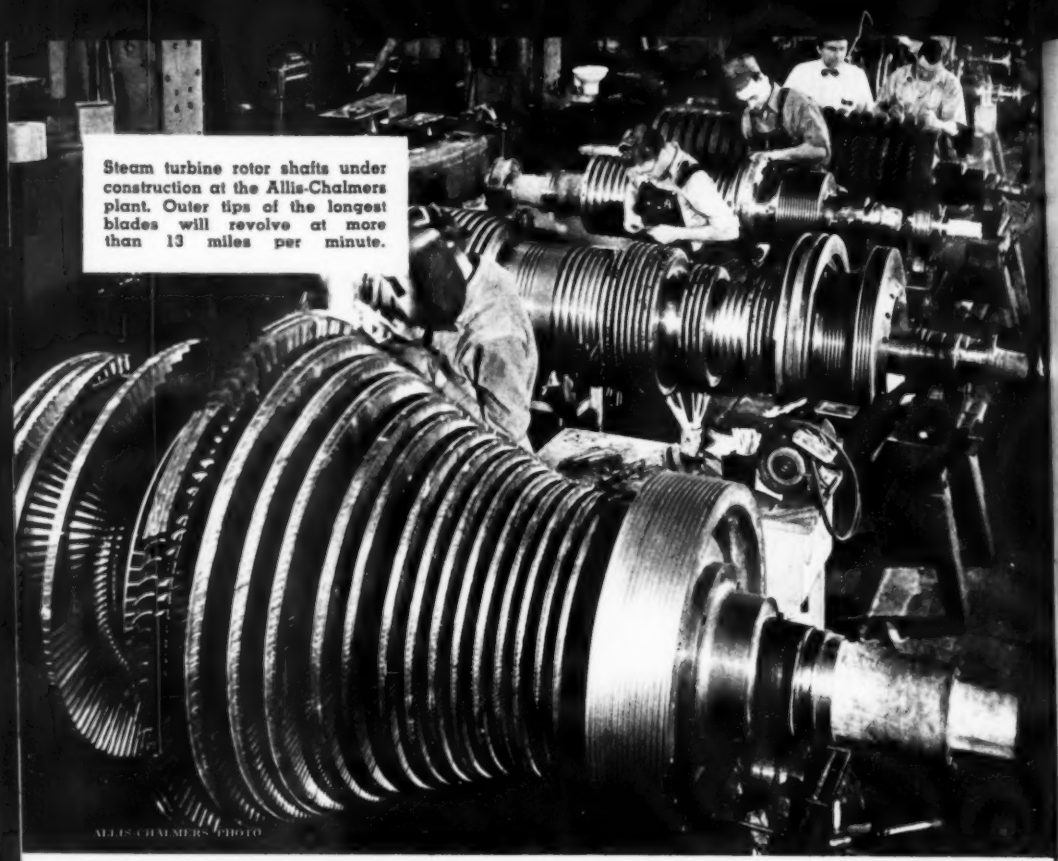


Next add a little carbon tetrachloride to this bromine solution and shake thoroughly. Free bromine will be dissolved in the carbon tetrachloride which will concentrate it into a dark brown solution and separate it from the water solution as shown in photo (right).



You can make oil of wintergeen by adding some sulphuric acid to ½" of wood alcohol in a test tube and shaking up a powdered aspirin tablet in the mixture (above). Stopper tube lightly with cotton plug and let stand in warm water for fifteen minutes. Upon smelling the tube you will notice odor of wintergreen (right).

Formaldehyde can be obtained by heating a coil of copper wire to red heat and plunging it into the vapor of warm wood alcohol. Strong pungent odor of formaldehyde will be evident. Copper wire is a catalyst.



Steam turbine rotor shafts under construction at the Allis-Chalmers plant. Outer tips of the longest blades will revolve at more than 13 miles per minute.

ALLIS-CHALMERS PHOTO

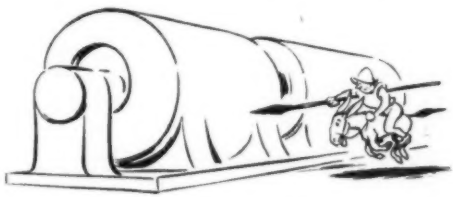
STEAM TURBINES

THEIR POWER BACKS OUR WAR EFFORT

by Roland Cueva and Lyne S. Metcalfe

IF DON QUIXOTE DE LA MANCHA were alive and kicking today he would probably have some little trouble in locating a windmill upon which to practice his mad jousting, and might have to accept its modern descendant as a target. The ensuing encounter between the good Don and a steam turbine would undoubtedly provide quite a spectacle, but would have sad results for the former, as his frail lance and decrepit steed hurled themselves against the turbine's steel casing. And could Quixote visualize the insides of this humming metal monster, with its fierce torrents of live steam driving the whirling blade tips at 13 miles a minute, he'd have a sudden nostalgia for the quiet, sunny fields and slowly turning windmill vanes of 17th Century Spain.

It may seem a far cry from the gentle wind power of the pastures to the prodigous steam turbine energy that today furnishes two-thirds of our electricity, and powers war and merchant ships, but the fundamental principles of both are identical. Both rely on some form of pressure being exerted against



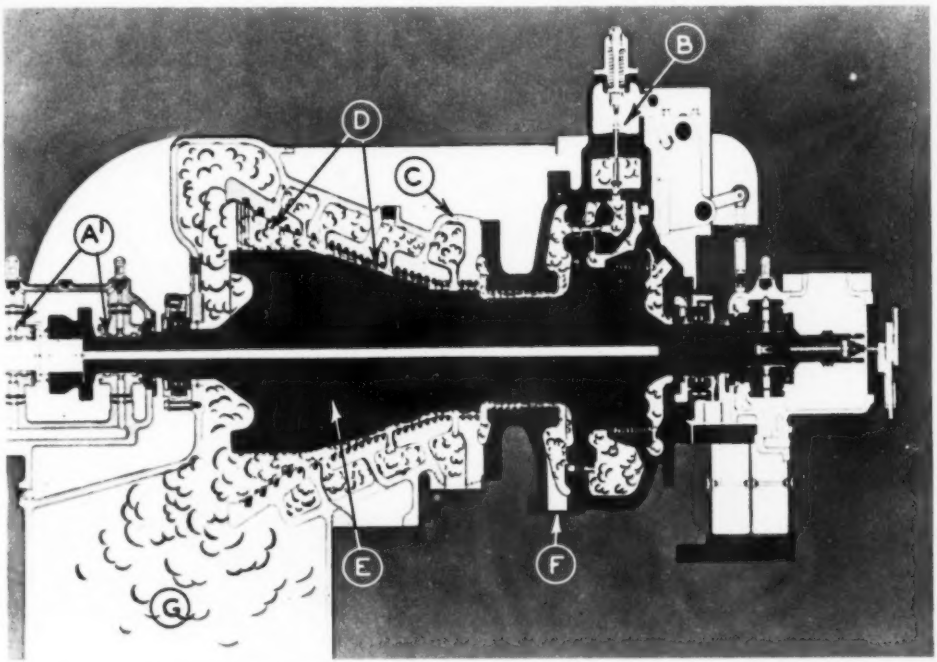
ILLUSTRATIONS COURTESY JAM HANDY ORGANIZATION

blades or vanes arranged around a central shaft which turns with them, transmitting its power to grain mill or dynamo.

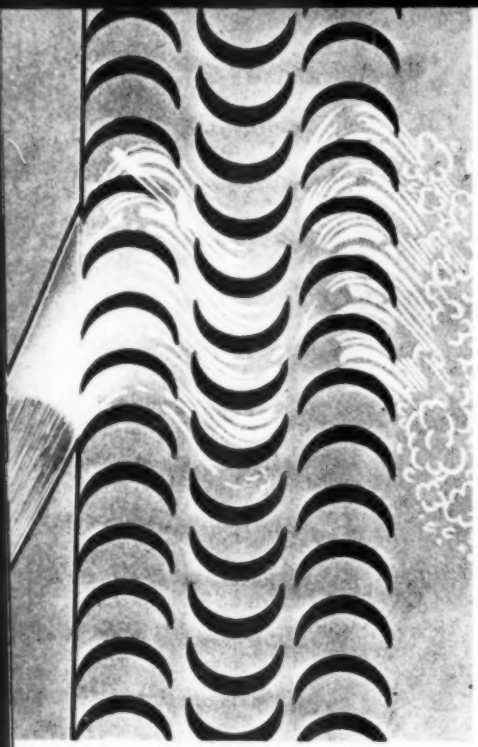
The war has necessitated the training of thousands of new operators, maintenance men and engineers in turbine operation, but many more are still needed, and this training has taken an important place in the war-time educational program. The editors of MECHANIX ILLUSTRATED have prepared this article as an aid in furthering the program. Like most mechanical units of more or less complicated character, the inner workings and operating principles of the steam turbine are a mystery to the average individual or student. Just what happens within the housing of a modern steam turbine to create such tremendous energy? How does it work?

Essentially, the turbine consists of two main components: a tapered spindle to which are attached radial perpendicular rows of blades set at a slight angle, and a housing containing other rows of stationary blades plus inlets and outlets for the steam. The spindle or rotor rests, of course, in bearings and drives the generator, ship's propellers or whatever else it may be attached to, as it revolves. Steam is introduced into the housing under pressure, and as it spurts from the nozzles at high velocity it strikes every blade a sledgehammer blow, ranging in force from 200 to 400 pounds against the first moving row. From there it is deflected by stationary blades to the next moving row. (See drawings.) The blades themselves are scientifically shaped to get the most out of every pound of steam hurled against them, before the

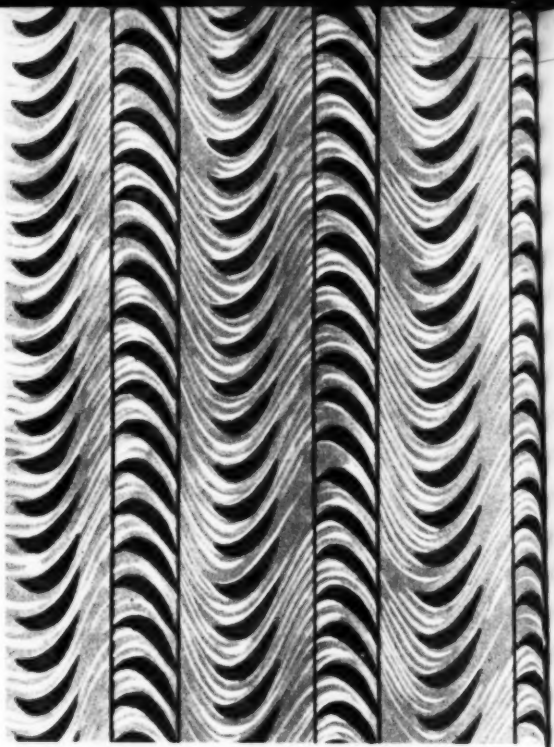
This simple experiment demonstrates the basic principle of impulse turbine operation. Steam spouting under pressure from the kettle causes paddle wheel to spin as it strikes the blades. At left is simplified model of impulse type. Large models are multi-stage.



Cutaway view of steam turbine, showing principal parts: (A, A') Bearings of shaft (B) Bypass overload valve (C) Cylinder casing (D) Reaction blading (E) Turbine shaft (F) Main steam inlet (G) Exhaust outlet.



When the steam jet strikes a blade, causing it to move, the steam flows along the contour of the blade faces. The middle row of blades is stationary; its function is to direct the steam to another row of rapidly whirling blades.

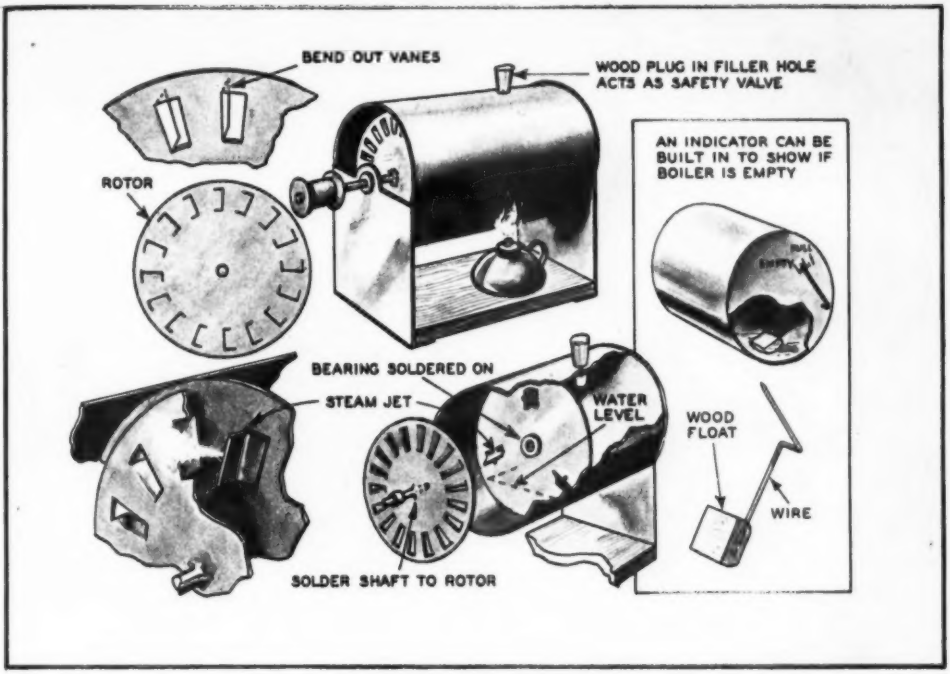


Stationary rows of blades direct the expanding steam to the moving rows where it applies a powerful reactive force. Each blade is impelled by a pressure equal to more than 200 lbs. Note optical illusion in above drawing which makes blade rows appear to taper. Actually they are parallel.

Because turbine spindles attain such tremendous speeds, bearings of careful design and extreme precision avoid wear and reduce maintenance costs.

steam reaches its maximum expansion and passes out the exhaust.

There are two basic types of steam turbines, though many turbines contain some of the features of both. They are called "impulse" and "reaction" turbines, and while many of their differences are too highly technical for discussion here, the fundamental difference is not hard to understand. In the impulse turbine the steam jets emerge from fixed nozzles and flow through the moving blades, causing them to spin. In the reaction type the steam jet nozzles are located in both fixed and *moving* elements, with the steam giving a "kick" to the blades, much in the manner of the burning powder in a July 4th pinwheel. A simple analogy from the realm of physics may help visualize these two actions. A tea kettle is placed in front of a wooden paddle-wheel (see photo), and the steam jet from the spout is allowed to play on the paddles. This, roughly, demonstrates the impulse-type turbine. The reaction type may be improvised by placing the kettle on rollers, with



MODEL STEAM TURBINE

The little model turbine sketched above can easily be built from a couple of old tin cans, some wire and a spool. Shears, knife and soldering iron are the only tools required. The model is extremely simplified, but will entertainingly demonstrate the principles of impulse turbine operation, and by use of the spool on the shaft as a pulley can be made to run a toy generator, derrick, etc. The bulkhead which separates water compartment from rotor must be fitted and soldered carefully so as to be watertight. Steam jet outlets and bearing are, of course, completed before bulkhead is placed. If you wish to experiment further with this model you can try making one with three sets of "blades," the center row stationary, as on page 94. This will more closely simulate the action of a real turbine.

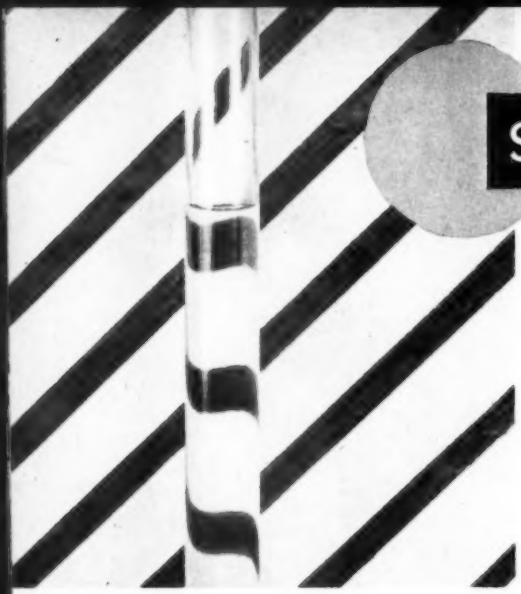
the lid tightly in place. Pressure is built up through confinement and forces the steam through the spout, moving the kettle.

In many modern turbines the impulse and reaction principles are combined in "stages," the steam from the boiler entering the casing at the small end, passing through the impulse stage and then on to the reaction blading. As the steam progresses along its path through the turbine its volume expands enormously, and the blading increases in length to gain the maximum efficiency from this expansion. By the time the steam has left the turbine and gone to the condenser each pound has expanded from less than one cubic foot at the inlet to six hundred cubic feet at the exhaust. The energy released from such expansion is tremendous, and will spin the tips of the largest blades at 1,259 feet per second, a speed faster than sound. Naturally, great strength is required in the blades to withstand the centrifugal force set up by such speeds, and the entire turbine must be constructed to watchmaker's precision in order to operate efficiently over long periods of time.

Steam turbines work best at very high speeds, and must have efficient lubricating systems, as well as speed "governors" to keep them turning evenly at a constant number of revolutions per minute. Because the steam travels through the turbine at high velocity, much of its expansive force would be lost were the rotary speed reduced, and for this reason reciprocating steam engines are better where steady low speed is required. But as the science of engineering progresses to greater and greater speeds for driving ships, planes and power plants of all types, the turbine engine assumes a place of outstanding importance in the future of transportation and power production.

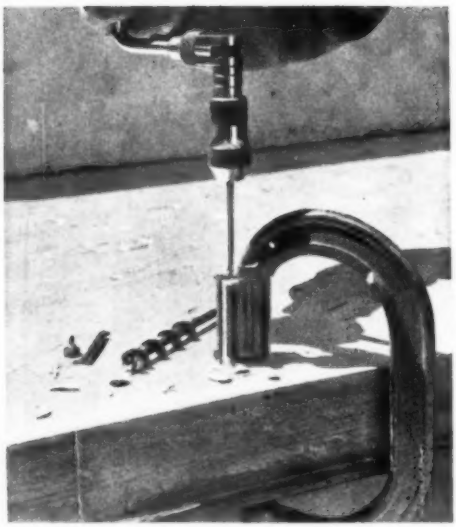
Perhaps we even shall see the airplanes of tomorrow driven at incredible speeds by light-metal turbines [*Continued on page* 138]

SHOP SHORTCUTS



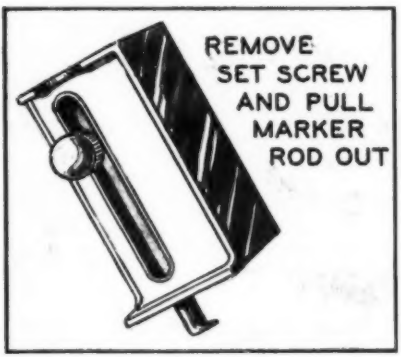
Black Lines On Background Aid In Reading Water Gauge

WATER gauges on furnaces, etc., are usually pretty hard to read either because they are placed in positions difficult to reach or because of poor light. Placing behind the gauge a white card on which has been drawn a number of heavy, black, diagonal lines will help you determine the water level in the tube. The refracting power of the water will distort the diagonal lines behind it and make them appear nearly horizontal.



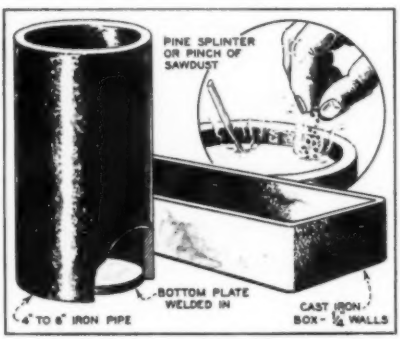
For Bluing Steel

TO BLUE steel prepare a container as shown. Melt in it 100 parts Potassium Nitrate (saltpeter) by weight and 8 to 10 parts Manganese Peroxide by weight. Heat to 400° F., or when a splinter of pine or pinch of sawdust will burn. Polish the steel, boil 5 minutes in caustic soda solution, DRY THOROUGHLY, and immerse in the prepared solution for 8 minutes. Remove, rinse, and dip in boiled linseed oil. Reheat solution to use again.



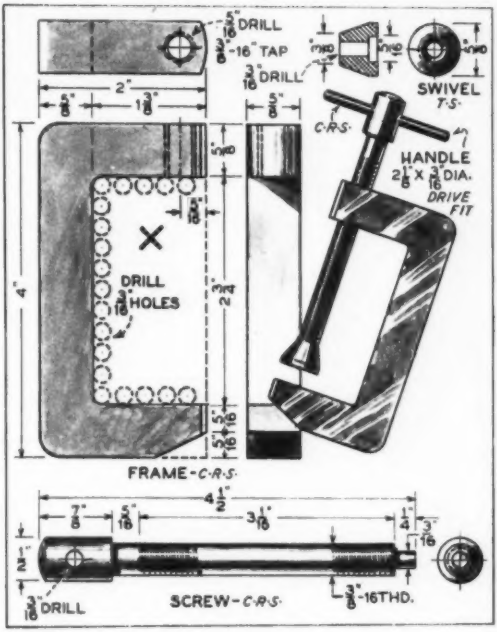
Handy Drilling Jig

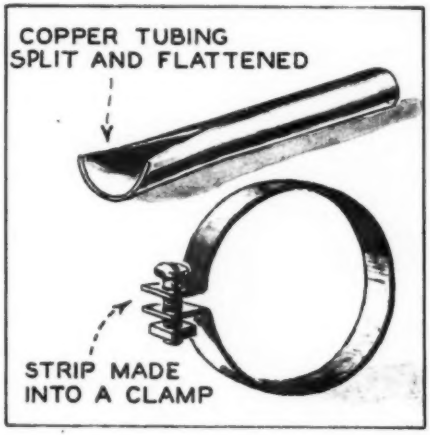
A CARPENTER'S butt gauge can be used as a guide for drilling. Simply remove one of the two marker rods and insert a $\frac{5}{16}$" drill in its place.



Machinist "C" Clamp

TRY this on your drill press and bench lathe! Select stock from cold rolled steel as in drawing. Square up ends, lay off lines and center punch for drilling. Drill 19 holes and remove X stock with hacksaw, chisel, file and plane. Finish frame as shown, drilling a $\frac{5}{16}$" hole and tapping for $\frac{3}{8}$-16 N.C. thread. Thread the clamp screw for this hole and drill in the end a No. 13 hole for a $\frac{3}{16}$" handle, press fit. Chamfer the ends of the handle. In the swivel bore a $\frac{3}{16}$" hole and counter bore $\frac{5}{16}$", $\frac{1}{8}$" deep. Then cut off to $\frac{5}{16}$" length. Caseharden clamp frame.



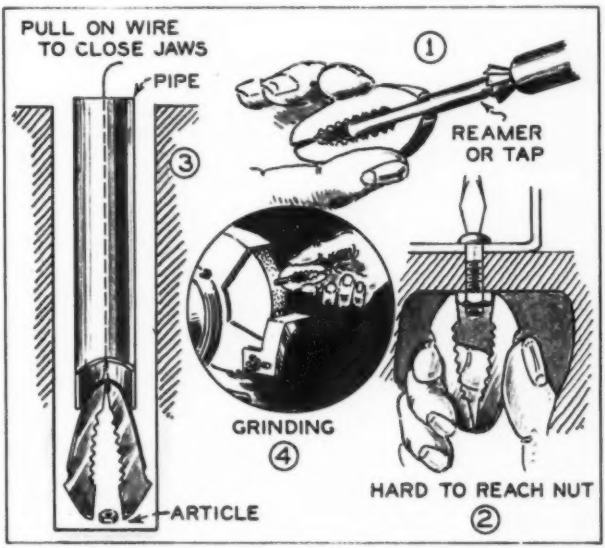


Simple Copper Clamps

IF YOU have some old copper gas lines lying around the garage, you can turn them into efficient clamps for your garden hose, car radiator hose, etc., by splitting them down the side, flattening them and drilling the ends as shown.

Uses For Worn Chuck Jaws

A PAIR of worn chuck jaws of the spring type used in a common brace can be put to work for other purposes as illustrated. (1) They can be used as a thumb and finger grip for doing light jobs of reaming and tapping. (2) They will be very handy for keeping nuts from turning in hard-to-reach places. (3) When inserted in a piece of short pipe they make a quickly contrived retriever for small articles. (4) On a grinding wheel, they enable you to hold short screws and other small parts without bruising your fingers.



VICTORY SAW TABLE

A circular saw is one of the most versatile tools in the home workshop. You will like this model.

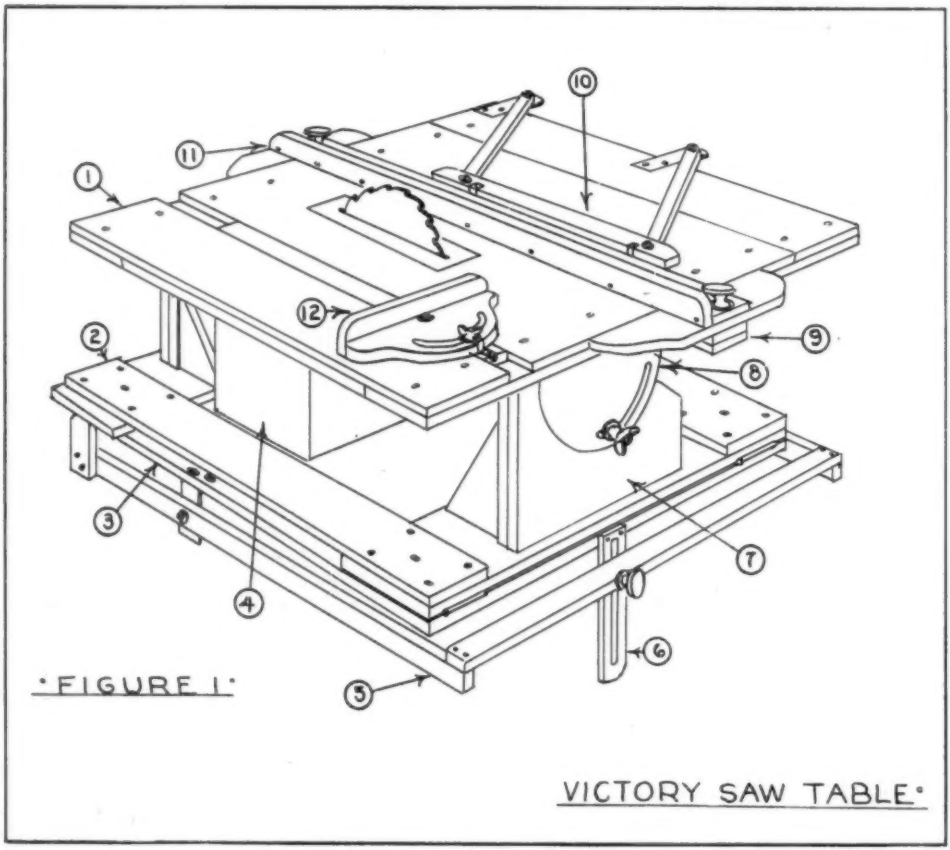
by A. H. Smith

A GOOD circular saw is out of reach of most workshop fans, and the cheaper ones are inadequate for any but very small projects. None are being manufactured today for civilian use, moreover, due to W.P.B. limitation orders covering critical materials. For these reasons, as well as the fact that more time is being spent in the home workshop these days because of curtailment of other activities, this saw table will be a pleasant and profitable project.

The actual table is 36″ wide and 26″ deep and uses an 8″ diameter combination saw. A ¼-h. p. motor can be used to power the saw. One of ⅓ or ½-h. p. would be proper, but in these times do not hesitate to call into action practically any kind of a motor available. By "feeling" work through the saw, this motor has proved satisfactory for many projects.

In construction there is a minimum of metal used and the few parts may be found in the average junk box or can be purchased cheaply. The wood is ¾″ clear pine which can be purchased in widths to fit. After comple-

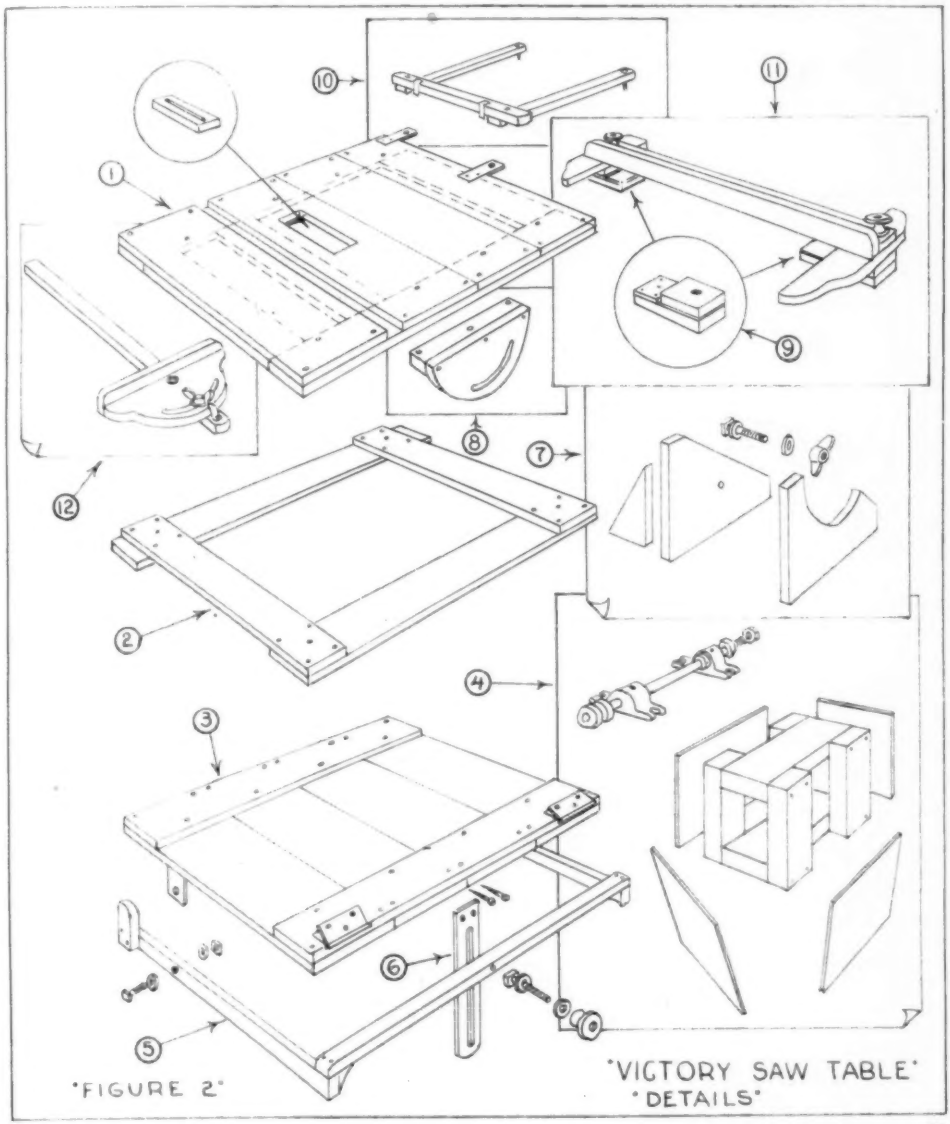
Here is the assembled saw table. Dimensions will depend upon individual requirements.



tion the table is given two or three coats of thinned shellac or a similar finish.

The main table top can be any predetermined size, but it is suggested that the width be approximately 36" to provide ample surface for operation of the ripping fence guide (part 10). Screws should be used throughout for assembling. A 1½" space is left about 8" from the saw at the left side for the cutoff gauge (part 12). The cutout for the saw should be approximately 1½" longer than the saw projection and 3" wide to give ample clearance when the table is tilted. A block is cut to fit this cutout, and, after the saw is mounted, a kerf is cut for the saw blade. A narrow ledge of light gauge metal is attached to the under side of the cutout at the ends to support this block which is removed when the table is to be tilted. Two ⅛"x1"x4" brackets are inset and screwed [*Continued on page* 132]

Details of the parts are shown below. Numbered parts are referred to in the text.



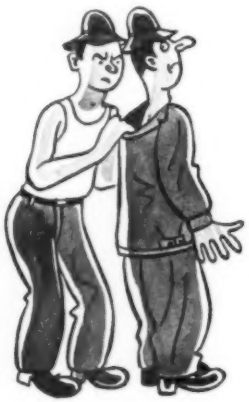
"FIGURE 2"

"VICTORY SAW TABLE"
"DETAILS"

IDEAS FOR SERVICE MEN

Here's a peachy from Corporal Pucci and begorra he sends it to us all the way from dear old Oirland. It's one for you guys in school: a combination foot locker and desk. The braces are hinged to the locker top and the desk, the desk top being recessed to take the braces. Make the top of ¾" plywood. The entire unit folds flat on the locker and can be opened in a jiffy. Front brace extends over locker edge to prevent desk from tilting. This picture shows our hero at work (probably writing to some femme! Wonder if that's her picture in the background??)

Before going down for the third time Corporal Howard Spangenberger threw out this little idea which took the boys by storm at the Erie Proving Grounds, Lacarne, Ohio, and we're advising you. "Take your dog tag," quoth he, "put some indelible ink on the *back* of it where the letters of your name, serial number, etc., stick out, and use it as a printing press to stamp your credentials on your dainty (?) underthings. Put the tag on the spot to be marked and rest an iron or heavy board on top to get a good pressure." It works! He sent us samples to prove it.



Don't faint at this one, fellars, and don't laugh, either; you might need it some day. An M. O. of the friendly type passed this

good word to E. E. Savage of the R. C. A. F., Toronto, Canada, who was kind enough to pass it to us to pass along to you so you can pass it to your pals, etc., etc. If some day, you should feel faint after standing at attention for a long interval, this is the remedy! Rise up on the balls of your feet very slowly, clench and unclench your fists several times and slowly lower yourself back on your heels. Repeat a number of times. This movement will restore your circulation, and the beauty of it is that it can't be detected from the front and rear and only slightly from the flank. At ease, men!

This month we have **something really new** for you—an idea picked up by ye ed. A few nights ago, while browsing in a local pub, he was startled to observe a bright gleam emanating from the service ribbon of a sailor lined up a-ways down the mahogany. Thought ye ed: "Either I've had one too many or they're making these things of metal now."

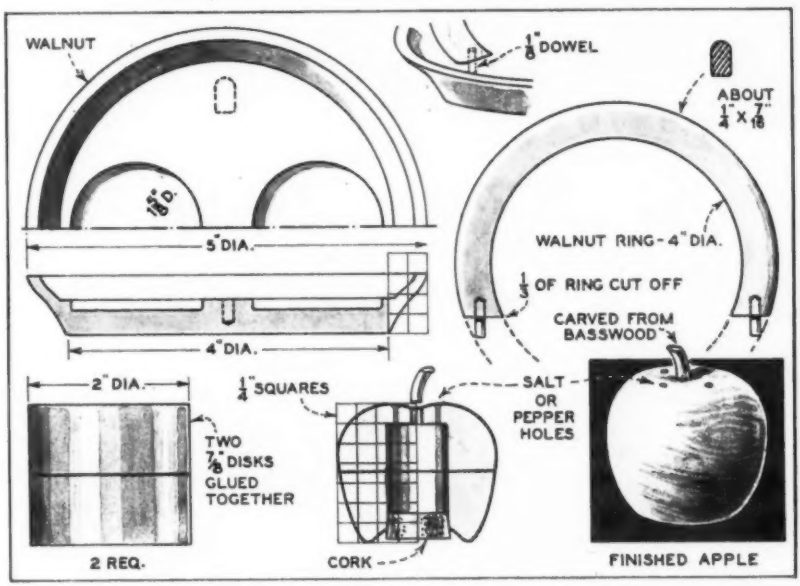
But lo and behold, to coin a phrase! Moving up to a closer salient we discovered that the ingenious wearer of the ribbon had resorted to the strategy of the cigarette companies to keep his ribbon clean—in short, he had wrapped it in cellophane. And having noticed, in [*Continued on page* 138]

THINGS TO MAKE FOR Christmas

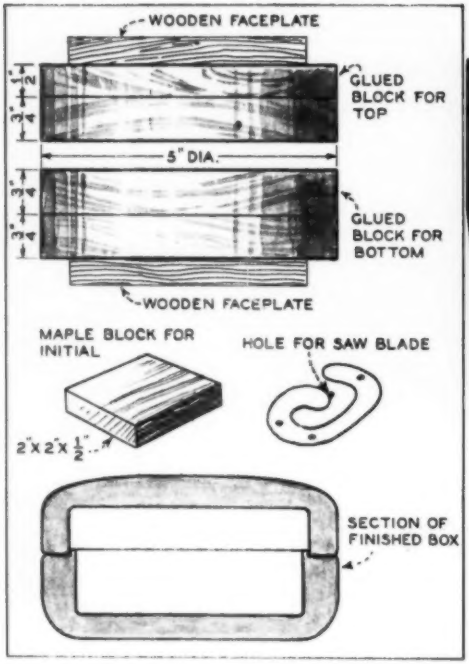
BASKET OF APPLES

SALT and pepper shakers in a great variety of forms can be turned out in the workshop, but if you want something really different and eye-catching for a gift, make up this basket of apples. The black walnut basket, with recesses in the base to keep the apples from slipping, makes a handy container for passing the shakers. The shakers themselves, cut in the form of apples, were made in Padouk, in the original set. This wood takes a high polish and is bright red, giving the true apple color. However, if this wood is not available, substitute a light wood to give the illusion of a yellow apple.

To make the block from which the apples are turned, glue together two 2" circles of wood, ⅞" thick, using a good casein glue. This gives a 2"x2" block. Or the apples may be cut from solid 2"x2" stock. Glue the apple block to waste stock, mount on the faceplate and turn out the center of the salt cellar, as shown. [*Continued on page* 136]



This apple design salt and pepper shaker set makes an attractive and original Christmas gift. Photo of the completed set is shown at the top, while construction details are seen directly above. Use Padouk wood, maple or Honduras mahogany. Tray base is of walnut.



INLAID JEWEL BOX

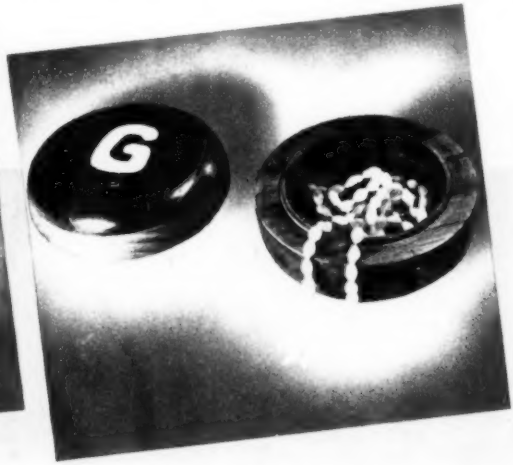
If you are looking for an unusual gift project, try your hand at this jewel case. It is made of walnut and has initial inlaid in the cover.

FOR the bottom half of the jewel box, cut two circles of walnut ¾" thick and 5" in diameter. Glue these together to make a turning block 1½" thick. Glue a waste wood faceplate to the block.

For the cover of the box, cut two 5" disks, one ¾" thick, the other ½" thick. The initial is inlaid in the ½" disk before the two are glued together.

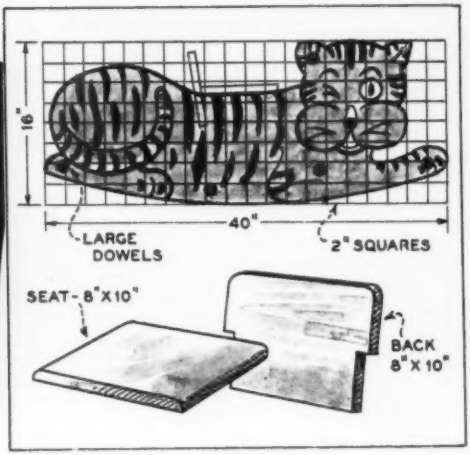
Cut a piece of maple 2" square and ½" thick for the initial. Cut a paper pattern and trace it in reverse on the walnut disk, placing it in the center. Through the letter in the walnut disk drill three holes with your smallest drill. Place brads through these holes and drive them into the maple piece so that it is in position covering the space which holds the drawing of the initial. Be sure that your brads are not long enough to pass through the entire thickness of the maple, for you will not want to mar the exposed surface of the initial.

Set the table of the jig saw at a slight angle and experiment with two pieces of scrap wood that are the same thickness as the maple and walnut pieces. That is, lay out the initial on scrap and saw out the two thicknesses of the letter. The tilt of the table will allow the top letter to slip into the cutout letter of the other piece. You may have to make several experimental cuts to [*Continued on page* 138]



TILLIE THE TIGER

Something a bit different in the way of a rocking toy is Tillie, our playful tiger. Youngsters can ride her safely; she won't tip over.



TILLIE is plenty large enough to accommodate a six- or eight-year-old child, yet a smaller child can ride her safely because she is low-slung and practically non-tipping.

She is 40" long and about 16" tall. If a single board for each side can be obtained in these dimensions, the work will be simplified a great deal, but just as attractive a toy can be made by using two boards 8" wide and fastening them together with wood cleats and wood screws on the inside to form each side of the tiger.

Wood ¾" thick is used for both the tiger sides and the seat. Although a band saw is the ideal tool for cutting out the figures, it is possible with patience and care to cut them out with a jig saw. Perhaps your local lumber yard has a band saw and will cut them out for you for a slight charge.

The bottoms of the rockers should have exactly the same curve. You can accomplish this easily if you are using a band saw, by tacking the two pieces of wood together and sawing out the rocker bottoms of both pieces at the same time.

The two pieces are assembled with ¾" dowels. Drill holes through both pieces at once. All the dowels, with the exception of the footrest, are 10" long. The footrest dowel is 18".

The edges of the seat piece are rounded off for the comfort of the young rider and the back piece is set in between the two figures at a slight slant.

Tap and glue the dowels into place, leaving 4" of the footrest dowel protruding from each side of the figures. Nail the seat and the back-rest pieces into place. Sandpaper all parts thoroughly after assembling. Paint first with light shellac then enamel. Tillie is colored orange with black stripes.

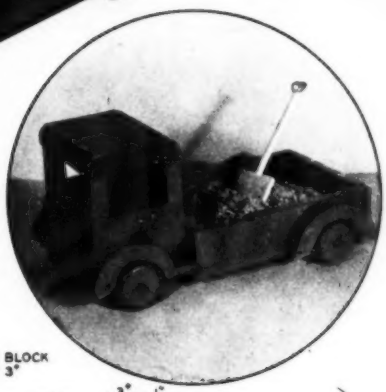
Here is Tillie, painted a realistic orange color with black stripes. Paint seat and dowels as desired.

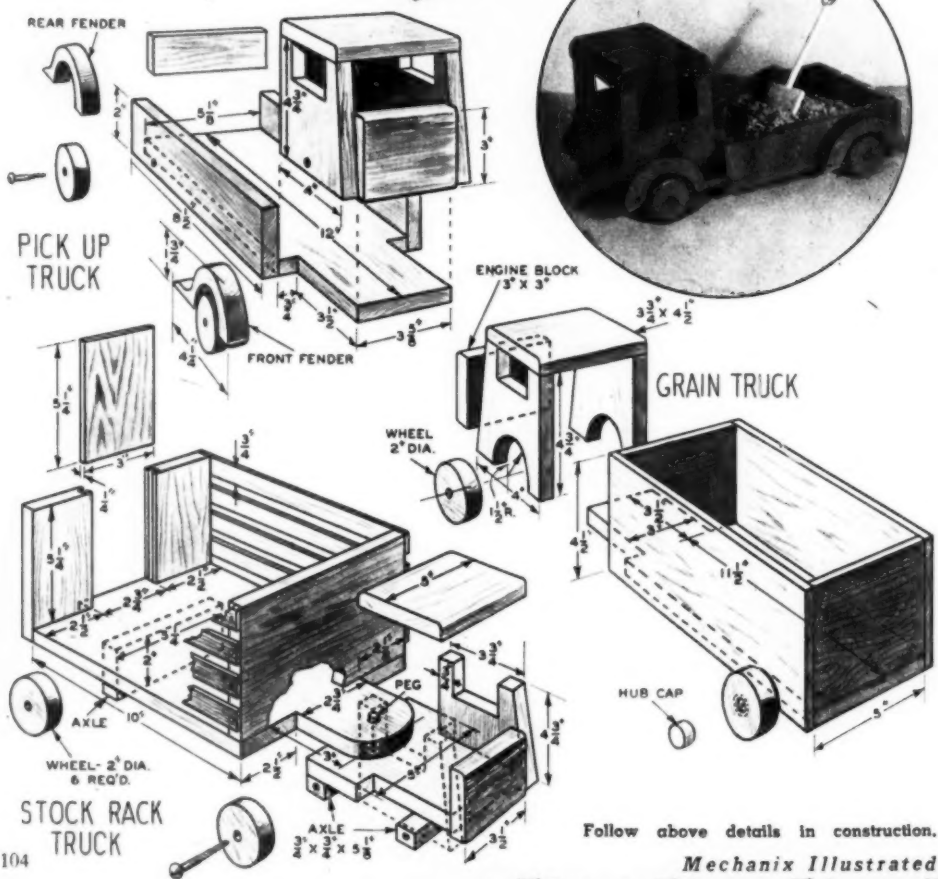
TRUCK FLEET

by Elma Waltner

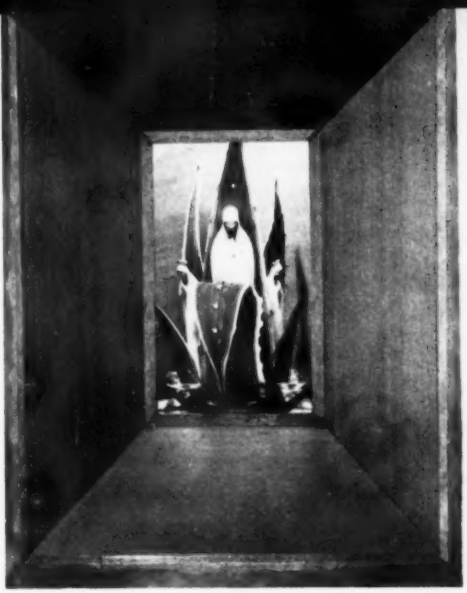
THE youngsters can toss these toys around to their hearts' content without fear of breaking them, for extremely rigid construction is a feature of their design. Use ¾" scrap wood for the bodies and ½" or ¼" for the sides. Fenders of pick-up truck are fastened to body with wire nails, and backs of pick-up and grain trucks may be hinged to bottoms if desired. Two coats of quick-drying glossy enamel serve as finish.

These sturdy trucks will gladden the hearts of all young engineers. Little sister will like to play with them, too.





Follow above details in construction.



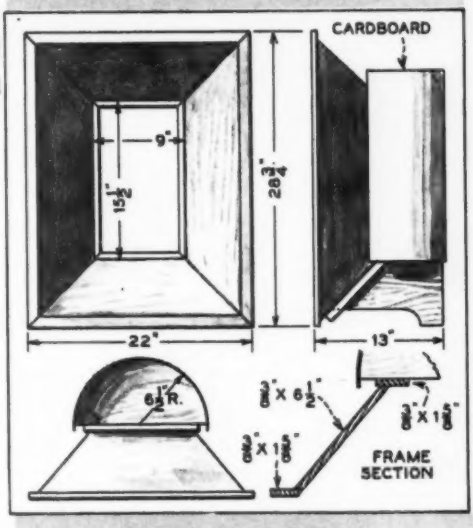
SHADOW BOX ART

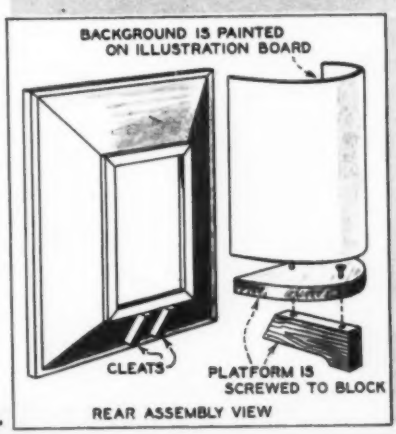
The popular shadow box offers many interesting possibilities. Try your skill with this model.

YOUR shadow box can reproduce scenes dear to memory with surprising fidelity; a vista in the Berkshires, a group down on the farm, that dude ranch in Arizona, or a view along the placid river. For general subjects, any appealing little figure will serve as a nucleus if one can visualize an appropriate setting. Novelty shops are a rich field for research. These two samples represent the clever work of Southern California artists and may suggest an idea to the novice.

Of course the frame is important, the unusual depth lending prominence to the scene. Natural light is admitted at the top; for artificial lighting, install a bulb above the set in back of the frame.

Making this frame requires only the simplest kind of carpentry except for some painstaking work mitering the corners where the pieces join. Better leave this to the mill or an accommodating cabinet maker if you do not have proper equipment for the job. Small brads and casein glue are used in assembling. Backgrounds are painted on illustration board bent around and tacked to the platform.





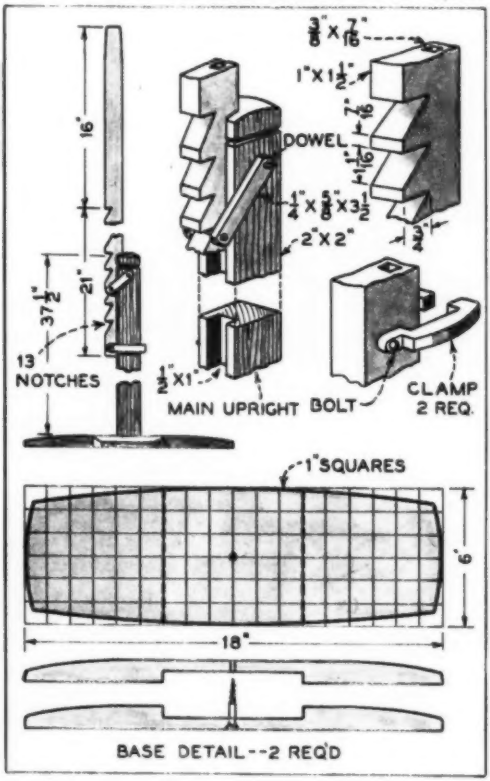
FRENCH PROVINCIAL LAMP

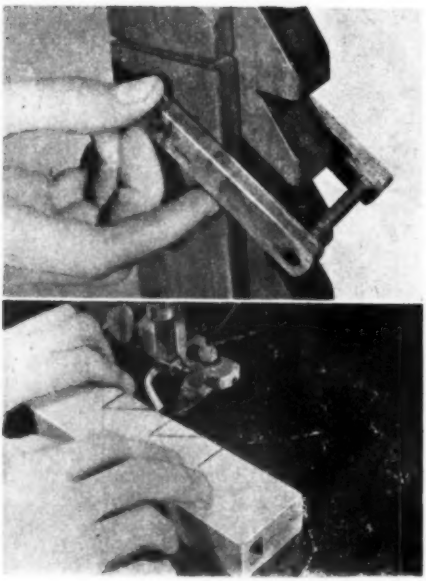
This adjustable floor lamp has been copied from the antique. Choose a finish to suit your taste.

THE 2"x2" main upright is grooved to receive sliding section. Two 1½" by ½" pieces are used for the sliding upright and are grooved so that when fastened, a ⅜"x$\frac{7}{16}$" channel is formed for wire. Notches are sawed in this piece, top is tapered slightly, and all edges are rounded. A wooden bracket guides bottom of upright, and swinging latch holds socket at desired height. Use ¼" dowel to hinge latch to upright.

The base is made in two sections as shown. A large screw holds base pieces together and also fastens them to upright. Round all sharp corners slightly and apply maple stain. Several coats of orange shellac make attractive finish, each coat being rubbed with steel wool. A 6" section of ⅜" o. d. pipe holds the double socket. An 18" parchment shade completes the lamp.

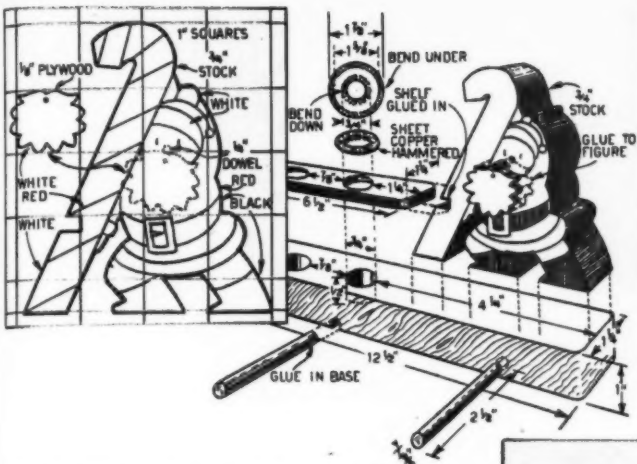
This model at the left was built of maple. Shade is tan parchment.





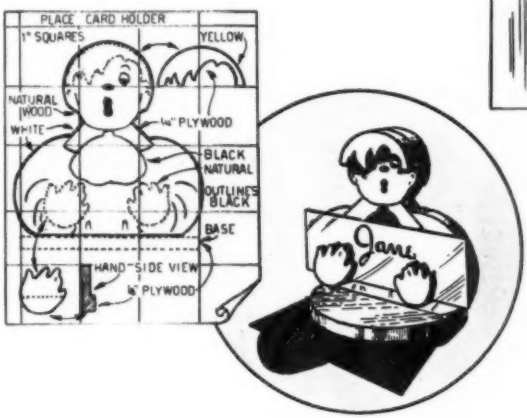
Photos at left show detail of latch arrangement.

JIGSAWED CANDLE HOLDER



This colorful candle holder will add Christmas cheer to your home during the coming holiday season.

TRACE two figures of Santa to ¾" stock. their beards to ⅛" plywood, and cut them out with a jigsaw. Drill ¼" holes and glue in short lengths of dowel for noses. Also glue the beards to their faces. Next cut the base section, 1¼"x12½", from 1" stock. Cut ten sections of ¼" dowel each 2½" long and glue them into the sides of the base, as shown, to keep it from tipping over. Drill the holes for the candles ½" deep. Saw the shelf 6½"x1¼" from ¼" plywood, round the corners and drill three ¾" holes for the candles. Glue this shelf into the notches in the candy canes. and nail and glue the figures to the base. Three drip shields are cut from sheet copper, hammered, and tacked around the holes in the shelf. Paint Santa with glossy enamel and finish the base and shelf the natural color of the wood. This holder is for 10" candles. Follow the drawing above.—*R. L. Fairall.*

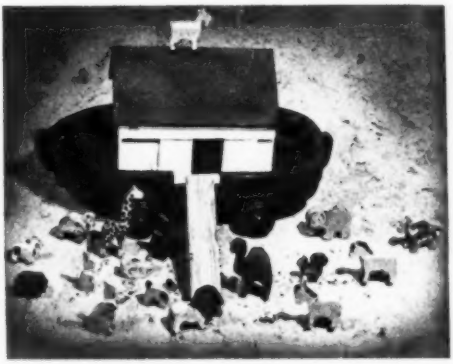


Choirboy For Place Cards

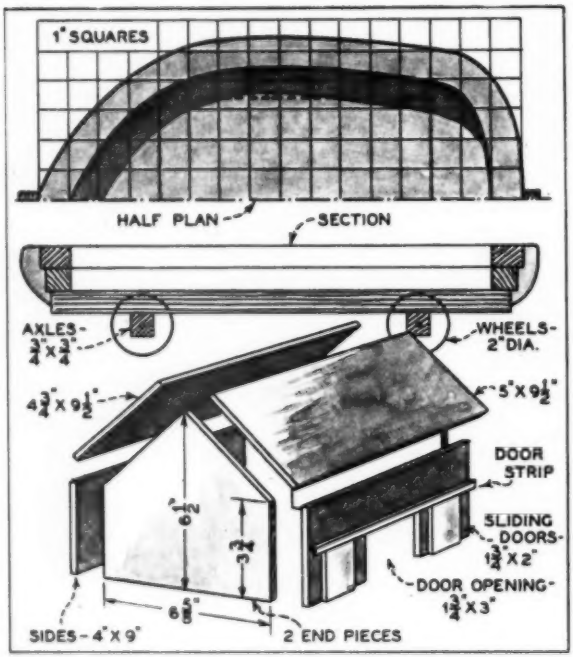
THE choirboy is jigsawed entirely from ¼" plywood and holds a standard size 3⅛"x1⅛" place card slipped behind his hands. Cut the hair and hands separately and glue them to the figure, the hands being attached only at the base. The figure is tacked to a 3" disk of plywood. Cut space from inner side of the hands for cards. Paint the figure with glossy enamel.

NOAH'S ARK
WITH ANIMALS

The original ark navigated only on water; this one is equipped for an overland journey on its smooth wooden wheels. There are lots of animals, too, to delight the hearts of modern, young Noahs.



Ark has sliding door; gangplank leads to deck. Animals are of laminated construction as shown.

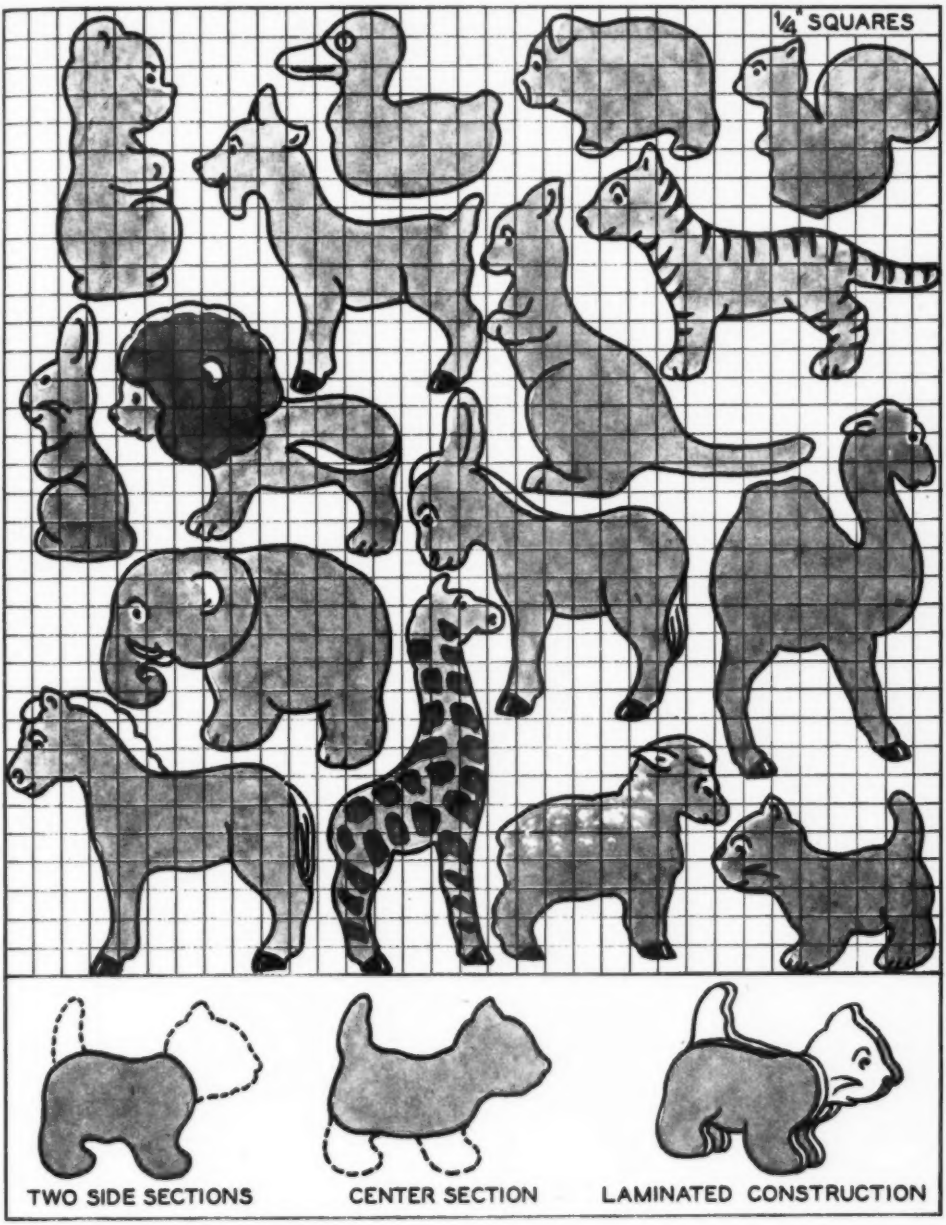


THE boat part consists of a bottom piece and two boat-shaped hollow pieces, each a bit larger than the other on the outside edge. These are fitted on top of each other and on the base piece, so that the boat is built up of three sections of ¾" wood. A 2" door is cut out of the two top sections at one side, so that the animals may pass down the gangplank.

Two axles are nailed to the bottom section, and the 2" wheels fastened in place with wood screws.

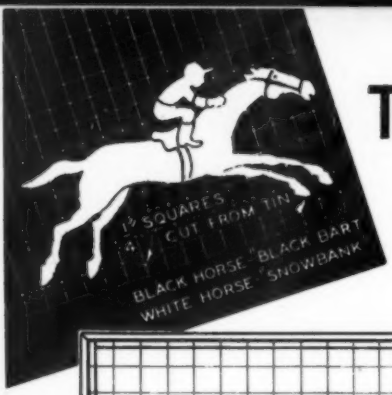
Cut the parts of the house of ¼" wood. Note that two dadoed strips allow the door to slide open and shut. Drive a small nail through each end of the bottom dadoed strip to keep the door from being pushed completely off. Fasten the house to the ark, with the door in line with the opening in the boat side.

The animals are of laminated construction, cut in three sections. If you have plywood scraps left from past projects, use them for the



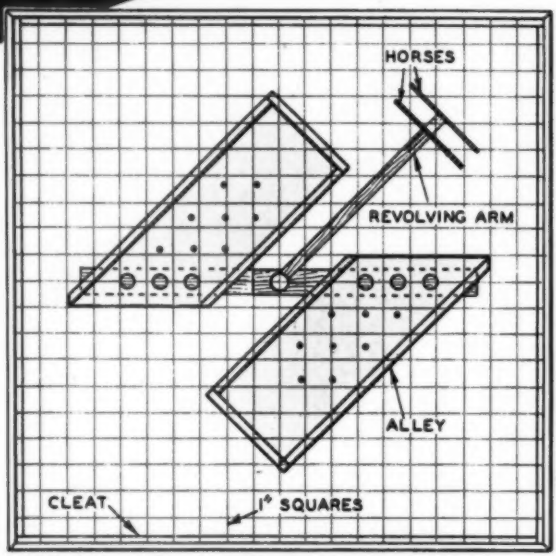
animals, for they give added strength and minimize the number of tragic accidents. Lacking plywood, use three thicknesses of ¼" wood, with the grain of the center section running horizontally, while the grain of the outside sections runs vertically. Lay out the animals and tack the three pieces of wood together; then saw out the three sections of the animals at once for a perfect fit after assembling.

Take the three sections apart. Cut the legs off the center section, and the head and tail off the two outside sections, re-assemble with glue and ¾" wire nails.

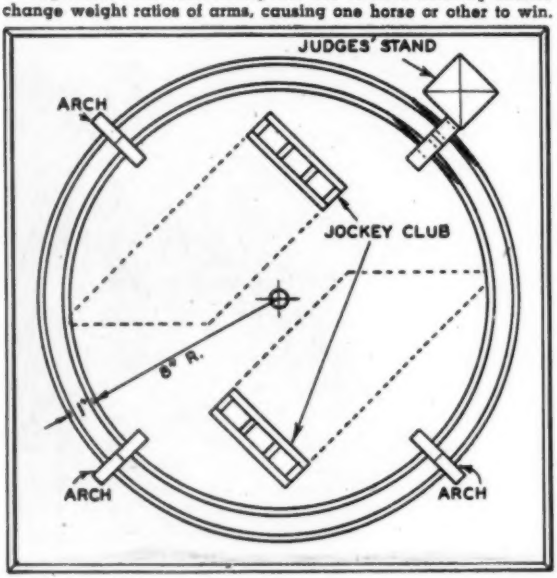


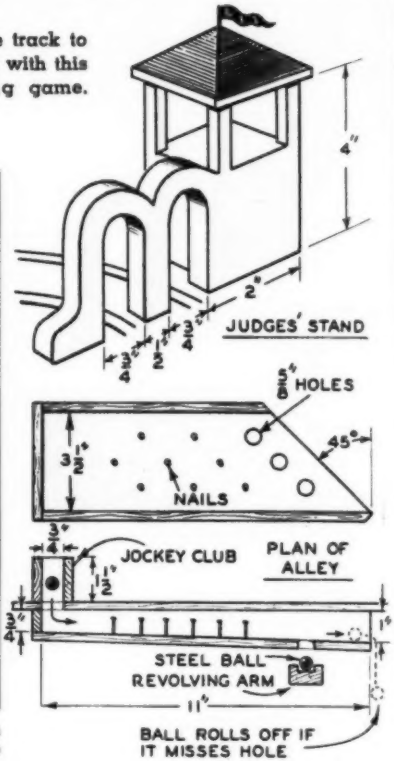
THIS HORSE RACE

Carry the thrill of the track to your Christmas party with this easily made racing game.



Layout of the track and details of the "flywheel" revolving arm arrangement. Steel balls falling into one of three holes by chance change weight ratios of arms, causing one horse or other to win.



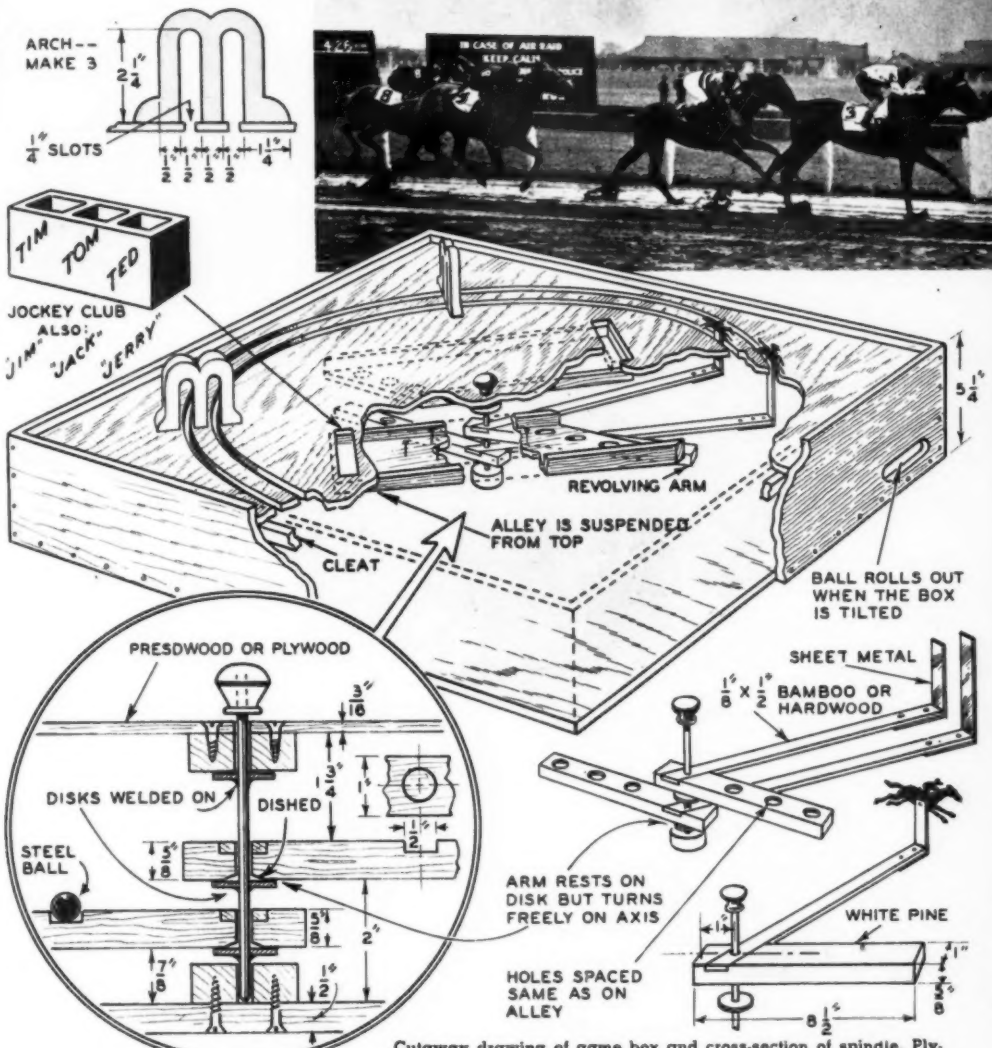


by Hi Sibley

NOT only is it impossible to bribe the jockeys or dope the horses in this race, but even the inventor cannot predict which one will win. "Black Bart" might come out ahead once and second several times in succession, or "Snowbank" might win and lose in alternate races.

The operating mechanism functions on the principle of a flywheel. Two flywheels of equal weight but of different diameters will not revolve an equal length of time with a given impulse. The larger diameter wheel will continue after the smaller has stopped. In this game there are two independent arms of the same weight, turning freely on an axis, and having shallow holes which register with holes above in

CAN'T BE "FIXED"



Cutaway drawing of game box and cross-section of spindle. Plywood ring between tracks is supported by screws into arches, as is center. Disk middle is prevented from sagging by washer.

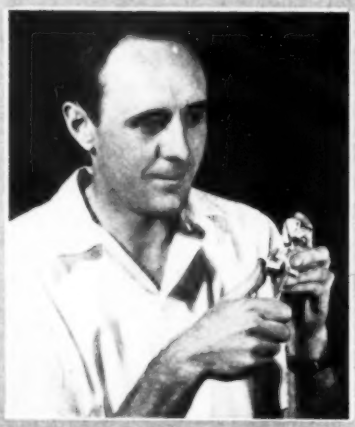
a sloping alley, set with staggered pins. The player drops a ball in one of the compartments in the "Jockey Club," it rolls down and comes to rest in one of the receptacles in the revolving arm, or misses a hole entirely and rolls off the alley to the floor of the box. The other player does likewise at the other Jockey Club. Neither can tell where his marble landed. If one finishes up in the hole at the outer end of Black Bart's revolving bar, and the hole nearest the axis in Snowbank's, the black horse will run farther and faster than his rival because of the flywheel action, the steel ball farthest from the axis acting as a flywheel of larger diameter. And if one or the other ball rolls off the alley [*Continued on page* 136]

WHY NOT WHITTLE IT?

Make original and attractive Christmas gifts by this simple and time-honored method.

by Glenn F. Chesnut

Right: This collection shows a variety of subjects, both novel and caricatured. Coping saw and sharp knife are the only tools needed to produce these items—humorous or serious.



The author at work carving the little dog sketched on the opposite page.

YOU can have a lot of fun whittling humorous characters out of wood. It's not hard when you get the knack of it, and here are some tips on how to get started.

To do caricatures you note the distinguishing features of the subject and then exaggerate them. You make long ears look longer and big noses bigger and so on. You also exaggerate posture.

You can use a jig saw to block out a figure and save a lot of time. Make sure your knife is sharp. The style of blade used doesn't make much difference as long as it is as sharp as a razor. Then you've got to learn to control it.

Don't just get a grip on the handle and freeze to it. Very often you have to hold the blade itself in your palm leaving only the point sticking out. Sometimes you push the blade with your thumb. Other times you have to guide it with one hand while applying the pressure for the stroke with the other.

Let's say you want to whittle out a hound dog like the one illustrated here. This is how you start.

First, get a piece of soft wood such as white pine or bass wood ¾" thick and draw an outline of the dog on it.

A good way to do this is to draw the outline on cardboard, cut it out and use as a template. You will find that the dog will fit snugly into a block 2½" deep by 2¾" wide. The next step is to saw out the dog with a jig saw or coping saw, and then you are ready to do the actual whittling.

With your knife cut away the wood on both sides of the dog's tail. The drawings may serve as your guide. Leave your cuts square, or angular. Next, cut away the upper edges of the nose so that it slants on both sides.

like a rooftop. Leave a narrow flat surface on top of the nose.

It is wise to cut away small chips and shavings and remove the wood gradually. By cutting away small portions you can study your progress and avoid making mistakes.

Look at the little drawing which shows the head only; notice how the cuts are made that shape the tongue. See how the front of the ears are formed by cutting away the sides of the dog's face.

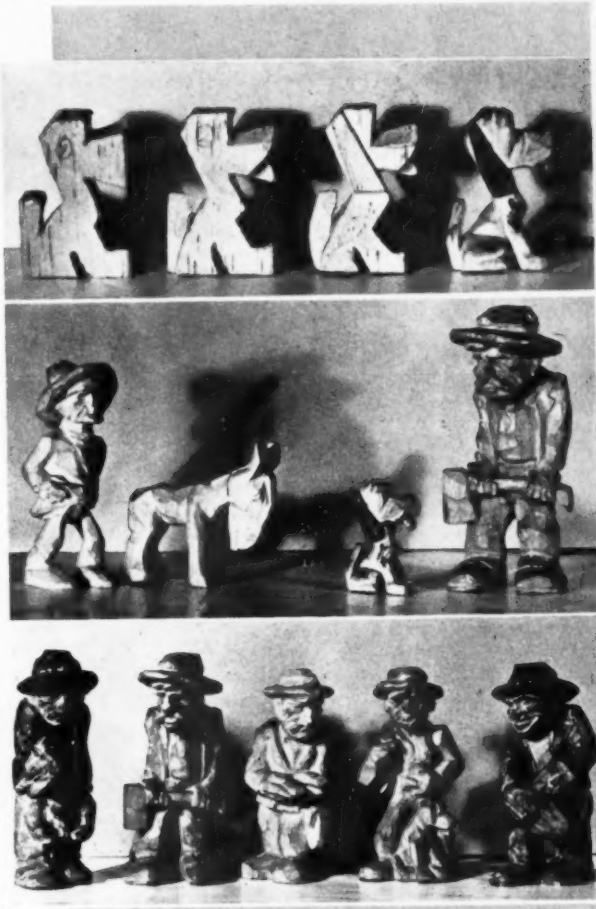
Turn your carving from side to side as you work. Look at it from all angles. This will help you to make sure both sides come out alike.

The back edges of the dog's ears are made by cutting away a little of each side of the neck. The bottom of the ears will take form when you carve the shoulder and neck, as seen in the drawing of the front view.

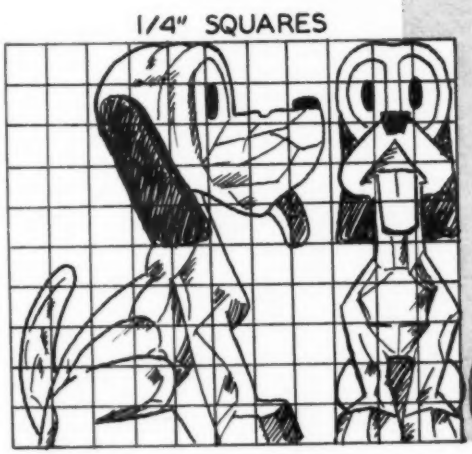
Now you can cut away the wood from between the front legs and shape the feet. At this point the carving is practically finished; it will look like a dog.

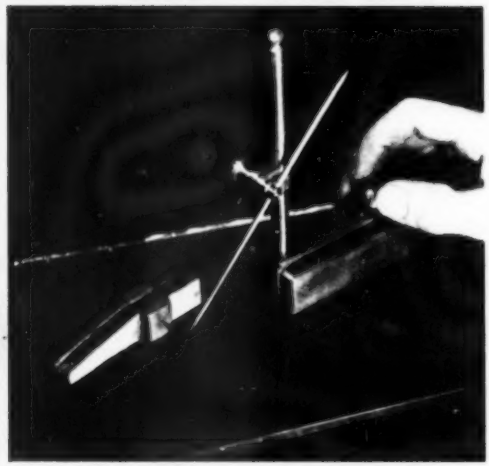
You can improve its appearance by cutting off some of the square corners. Not all of them—just enough to keep it from looking stiff.

The little angles and planes of the [*Continued on page* 138]



Top: Progressive steps in carving out the dog. Starting with the sawn block, he is gradually shaped by knife until finished. Center and lower: More examples of the author's efforts. Note how planes and facets of the knife strokes give rugged force to the characters. For your first attempt try the little dog shown here.





HOMEMADE SURFACE GAUGE

by Gordon Douglas

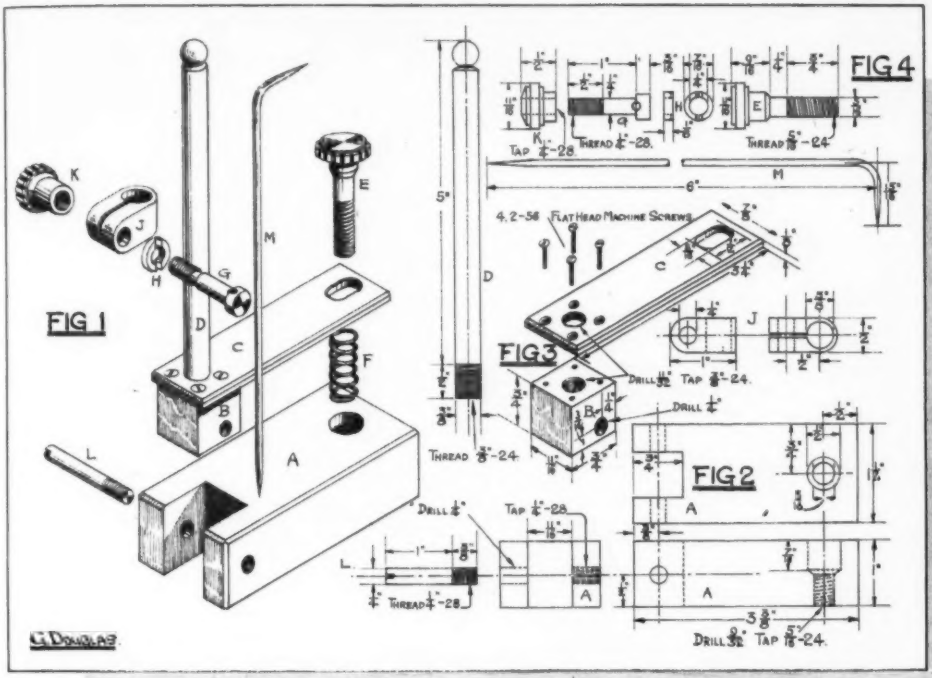
PROBABLY there are a great many home workshop owners who have sometimes wished they had a surface gauge on hand when setting up work in the lathe, or when marking off small castings for model work, etc. But such tools are expensive and in these times are likely to be unobtainable. Nevertheless, a glance over the drawings and photos accompanying this article will show just what the home craftsman can do in the way of turning out a very serviceable gauge for himself from odds and ends of material likely to be found in his own shop.

Fig. 1 shows the general construction and assembly of the various parts. The base A, Figs. 1 and 2, should be made first. A piece of mild steel bar 1″x1½″x3⅜″ long is used. Incidentally, if these dimensions do not fit in exactly with what you have, they can be changed slightly to suit material on hand. To proceed with the base, a slot 11/16″ wide must be cut in one end to accommodate the square block into which the spindle is screwed. The job of cutting this out is best done by drilling a series of small holes close together across the end of the slot, sawing down the sides with a hacksaw, and breaking out the unwanted portion. The end and sides of the slot can then be trued up with a file.

The next step is the drilling of the hole to take the pin, L. Drill, first with a 7/32″ drill, across the slot as shown in Fig. 2, and then redrill one side with a ¼″ drill and also tap the opposite side ¼″-28. The bottom should then be filed dead flat and the whole thing polished up all over. Polish with fine emery cloth and oil; it is a good idea to finish all the parts in a like manner, as the

Top: Turning the adjustment screws in the lathe. They are made from mild steel rod and knurled for finger grip. Above: The finished gauge in use on a glass surface plate.

Right: The simple parts of the gauge before assembly. Scriber can be bent to shape from a discarded steel knitting needle.



Dimensions and assembly details of the surface gauge. Because of its "rocker bar" design with adjustment nut at rear, it will perform accurate work efficiently if used on a flat base, such as the glass plate shown in the photo. This gauge is very helpful in marking out work for machining.

polishing gives a fine satin-like finish which adds much to the appearance, and also helps to prevent rust.

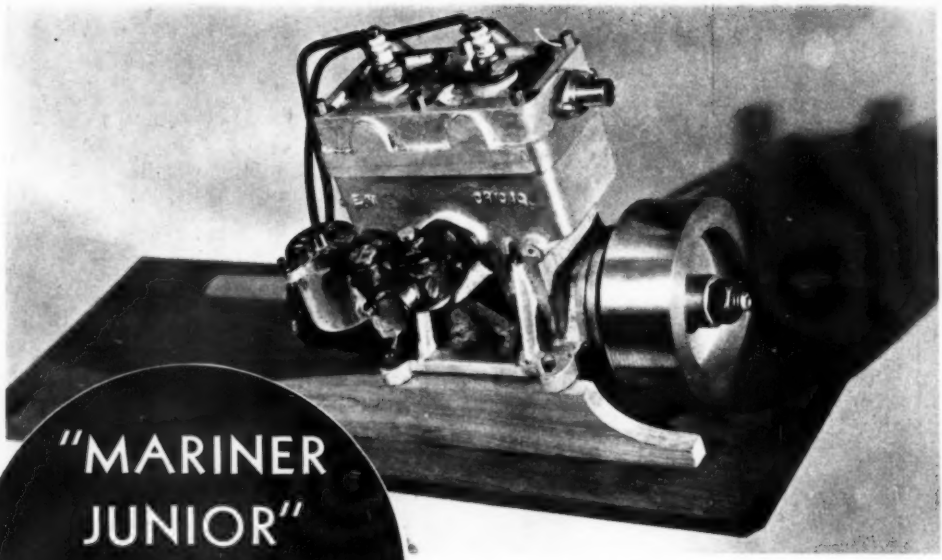
The square block B, Fig. 3, and the plate C should be made up next. The block is cut from a short length of ¾"x¾" mild steel to the dimensions shown, and should be a good snug fit in the base slot. The top plate C, is cut from ⅞"x⅛" flat steel, and is drilled and countersunk on one end for the four 2-56 flat head machine screws with which it is attached to the top of the spindle block. The other end is drilled $\frac{5}{16}$" and the hole filed slightly oval, as shown, to allow for a slight swinging movement on the adjusting screw E. When these two parts have been fastened together, the spindle hole should be drilled and tapped ⅜"-24 and a ¼" hole drilled through the block to take the pin, L.

The spindle, D, is made from a piece of ⅜" drill rod 5½" long, one end being threaded ⅜"-24 for a distance of ½". The top end can be left plain or turned up in the lathe, as shown in the drawing.

Clamp for the scriber, J, Fig. 3, is easily made from an odd piece of ½" square stock, the two holes for the spindle and clamping screw being marked off and drilled first, after which it can be filed to the shape shown and the slot cut with a hacksaw.

The adjusting screws, K and E, are both turned from a piece of ¾" mild steel rod to the dimensions shown in Fig. 4. These should be knurled to provide a grip for the fingers. If you have no knurling equipment a good substitute can be achieved by filing a series of small notches around the rims, as shown in the accompanying photos of the finished gauge.

The pin, L, on which the spindle rocks, the clamping screw G and the notched washer, H are all turned from odd scraps of steel rod. They should present little difficulty in the making. A word of caution about the clamp screw G: the hole for the scriber comes half on the head and half on the shank, and should be drilled before turning this part to size. The pin, L, should [*Continued on page* 138]



"MARINER JUNIOR" ENGINE

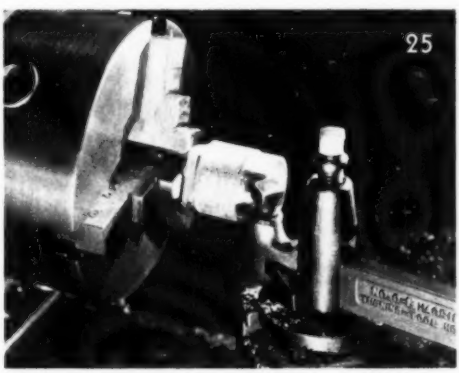
by
C. W. Woodson
PART II

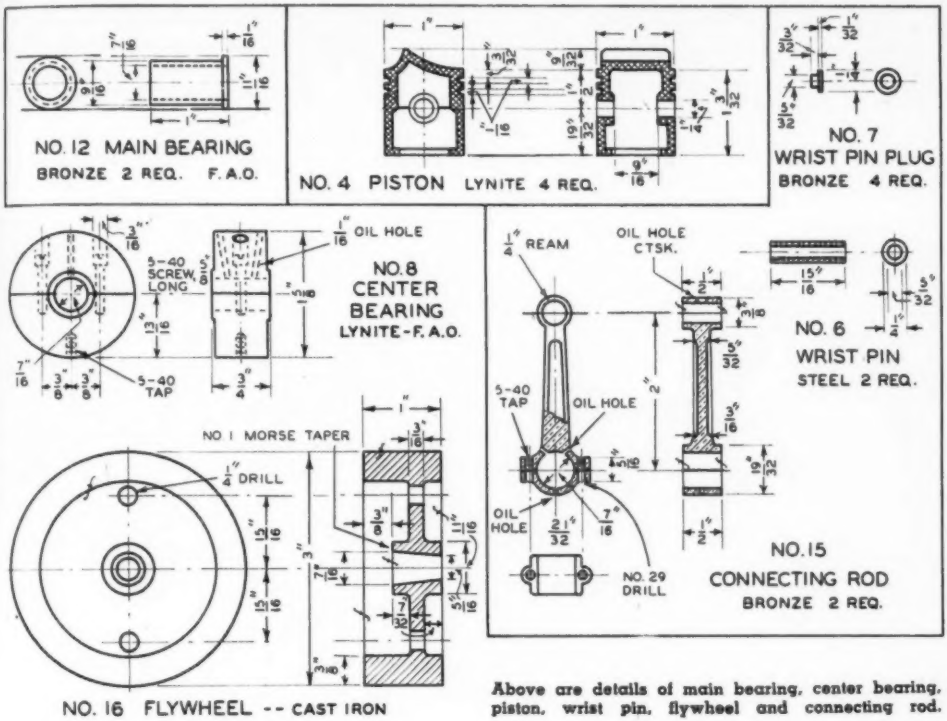
LIGHT, well-designed and powerful for its size, the "Mariner Junior" engine is ideal for powering working models of boats, running small compressors, etc. It delivers one-half horsepower at 7,500 r.p.m. and is water-cooled. Anyone possessing a metal turning lathe can make it, either from their own castings or a set of purchased castings. If you do not have the facilities for making the castings, or lack experience in this process, you will get better results if you use the kit, and in addition will save much construction time. E. A. Wall of the Wall Laboratories, Chicago, is the designer of this neat little gas engine, and has the kits of castings available.

Last month, in the first installment of this article, we described the machining of the basic engine parts, such as the cylinder block, head, sleeves and crankcase. Now we will finish up the job, and take for the first step the pistons.

The Lynite pistons have a chucking lug cast on the upper end, making the machining of these parts a simple lathe job. The piston should be chucked first with the lug out where it can be turned to run concentric with the body of the piston.

It then can be reversed and chucked, as in Photo 25, where it is turned to a nice sliding fit in the cylinder bore. The lower part of the skirt then can be bored smooth and true as far up as the piston bearings. The lower end of the skirt should be turned, bringing the overall length of the piston to exactly $1\frac{3}{32}$", as called for in the drawings. With the piston still chucked in this same position the ring grooves are cut with a parting tool, as in Photo 26. In cutting these grooves the piston ring should be used as a gauge both for width and depth of cut. The groove should be deep enough to allow the ring to sink slightly below the surface when in place on the piston, and



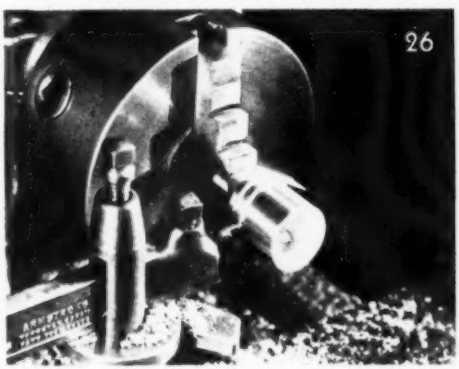


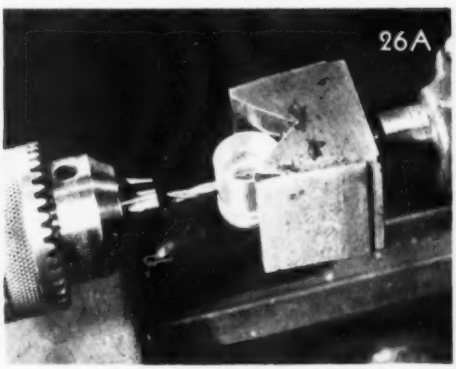
Above are details of main bearing, center bearing, piston, wrist pin, flywheel and connecting rod.

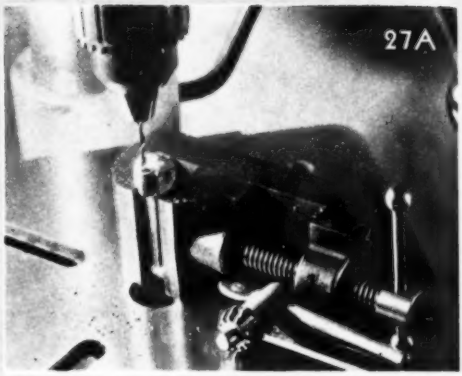
wide enough to be a snug fit in which the ring may be moved easily. The piston-pin holes can be drilled and reamed in the lathe while the piston is supported in the crotch center, Photo 26-A. This will automatically center the holes, a very important item. The chucking lugs can then be cut off and the piston head filed to shape. The piston pins can be made up to the dimensions in the drawings from 1/4" drillrod with the center drilled out for lightness. These are shown in Photo 27, along with a finished piston and also one with the chucking lug still attached.

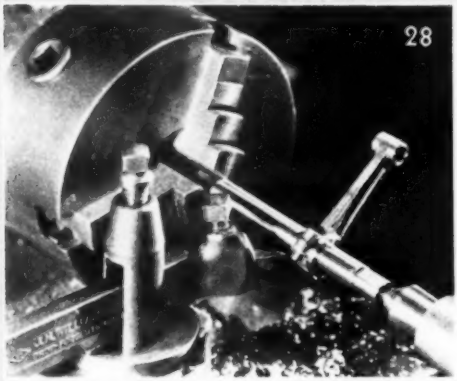
The bronze connecting rods are machined by first drilling the two screw holes in the big end, Photo 27-A, and cutting off the lower cap. The flat surfaces, where the cut was made, are machined smooth and the holes in

Photos below show the cutting of the ring grooves and drilling of the piston-pin holes.









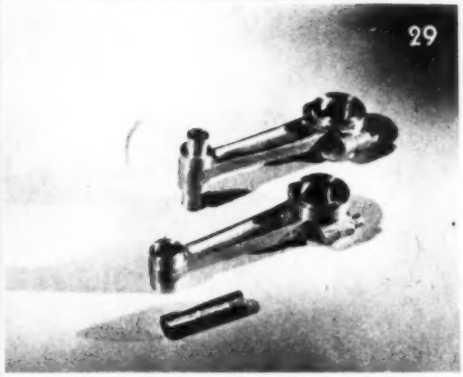


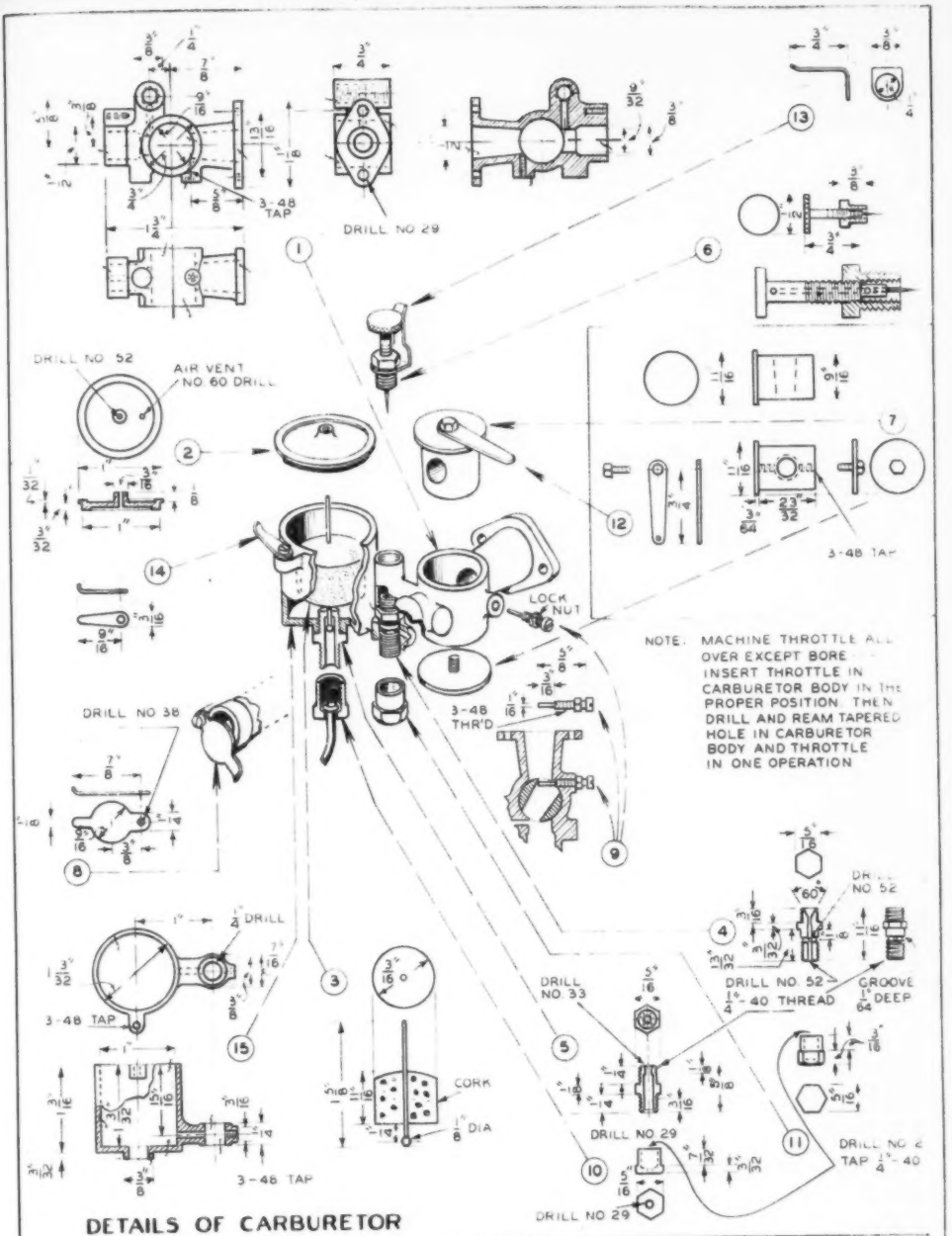
Photo 27 shows piston pins and pistons. Others show machining of the bronze connecting rods.

the big end of the rod tapped 5-40 as indicated in the drawings, while those in the lower cap are opened out to clear the screws. The two parts are then fastened together tightly and the crankpin hole drilled and reamed to size. The rod then is slipped on a mandrel, Photo 28, where it can be turned to correct diameter and proper width. The small end can be held directly in the three-jaw chuck, where one side at a time can be faced, turned to diameter and drilled for the piston pin. The completed connecting rods are shown in Photo 29.

The crankshaft is a rather difficult and very particular job and should be approached with much care. It is cut from a solid bar of steel, the built-up type being entirely unable to withstand the terrific stress this part of the engine must take, especially when running at 7,500 r.p.m. The line drawings show how the crankshaft is laid out accurately, how waste material is cut away by drilling and sawing and how each consecutive operation is accomplished. Photo 30 shows the crankshaft pretty well completed, the last finishing cut being taken on the tapered end.

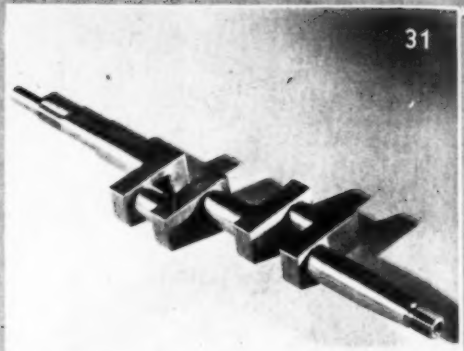
Turning a taper requires care, and in this case it must fit the reamed hole in the flywheel perfectly. The compound rest of the lathe can be set fairly close to the proper angle for turning this taper by chucking the Morse number 1 reamer, used in the flywheel hole, and adjusting the compound rest until the cutter closely follows the taper of the reamer when run back and forth with the compound feed screw.

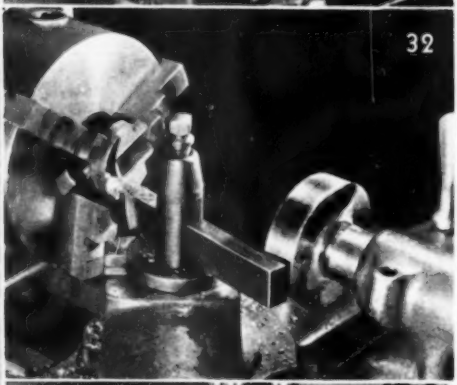
From here on the cut and try method should be used in adjusting the compound rest until a perfect fit has been made. In turning tapers of any kind it is quite essential that the cutting edge of the tool be set at exactly lathe center height. If set even slightly below center the tool will gradually run under the work as it nears the small end of the taper, and if set above the center it will tend to run over the

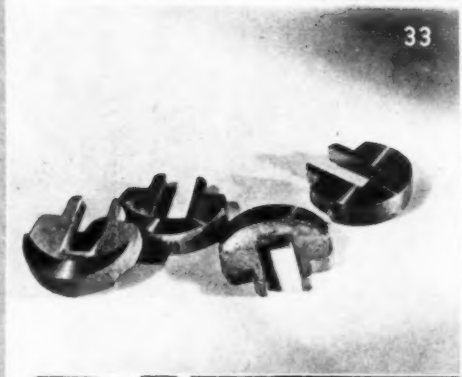


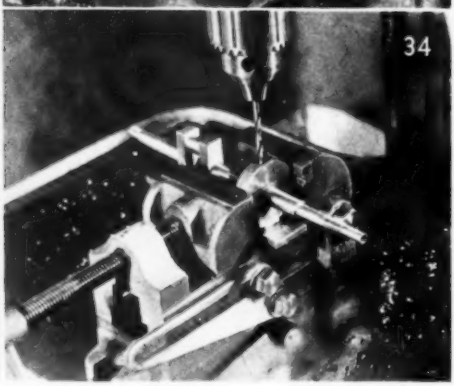
DETAILS OF CARBURETOR

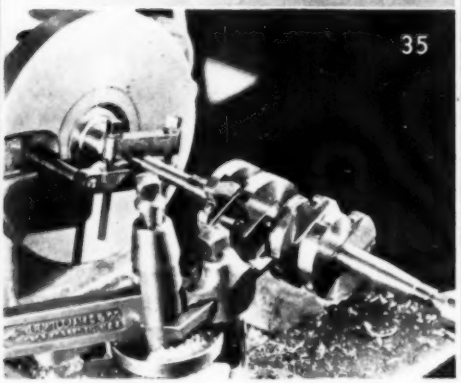
Carburetor parts: (1) carburetor body, (2) cover, (3) float, (4) main jet, (5) valve seat and gas connection, (6) main jet needle valve, (7) throttle, (8) choke, (9) throttle adjusting screw, (10) union nut, (11) chamber nut, (12) throttle lever, (13) friction spring, (14) cover retainer spring, (15) gas chamber.



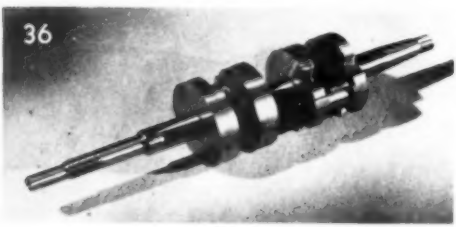








In photos above, the crankshaft and counterweights are machined. Finished assembly in photo below.

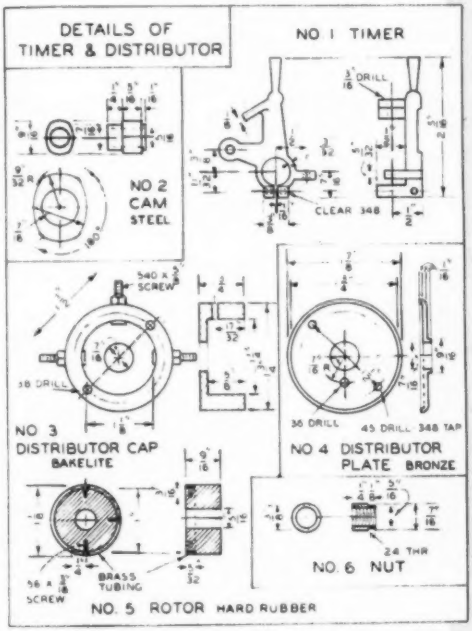


work and not follow the angle at which the lathe compound or taper attachment is set.

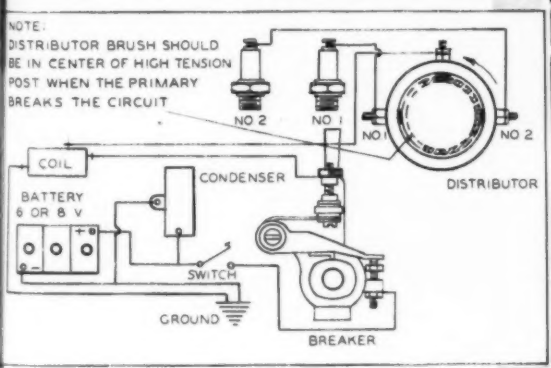
Photo 31 shows the completed shaft ready for the counterweights. These are machined on both sides by taking a facing cut while chucked, as in Photo 32. They are chucked to run true by holding the casting flat against a small drill pad mounted in the tailstock while tightening the jaws of the chuck. When

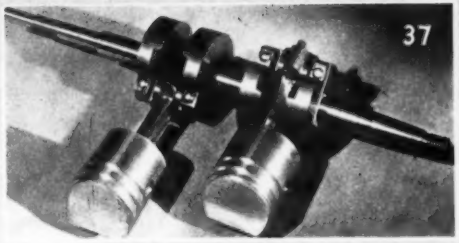
the drill pad is used to hold thin, hard-to-chuck discs of any kind parallel to the face of the chuck while the jaws are being closed, the work will run absolutely true. The four counterweights are shown machined on both sides in Photo 33.

Each weight is hand-fitted to its respective crankweb by filing the slot to size. The holes for screw-fastening the weights in place are drilled, as in Photo 34, while the weight is in place on the crankweb. The hole in the web is tapped while the one in the weight should be opened out to clear the screw, and also counterbored as

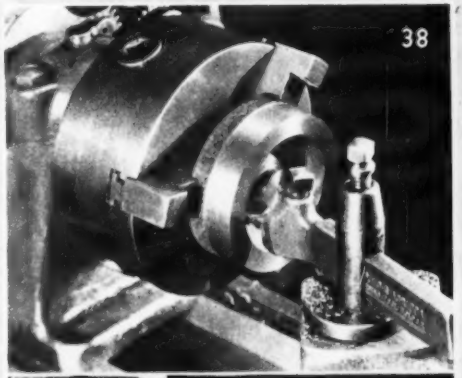

DETAILS OF TIMER & DISTRIBUTOR
NO 1 TIMER
NO 2 CAM STEEL
NO 3 DISTRIBUTOR CAP BAKELITE
NO 4 DISTRIBUTOR PLATE BRONZE
NO. 5 ROTOR HARD RUBBER
NO. 6 NUT
BRASS TUBING

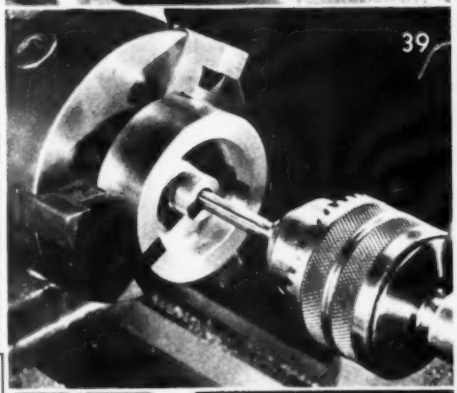
This is the timer and distributor above. Follow the simple diagram below for wiring.

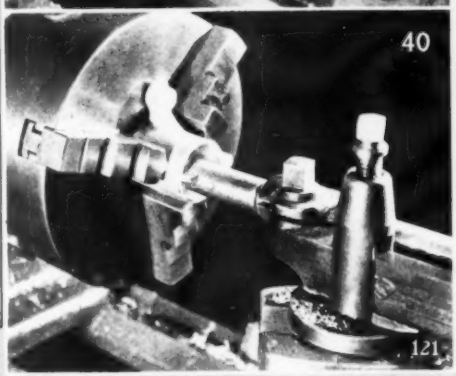


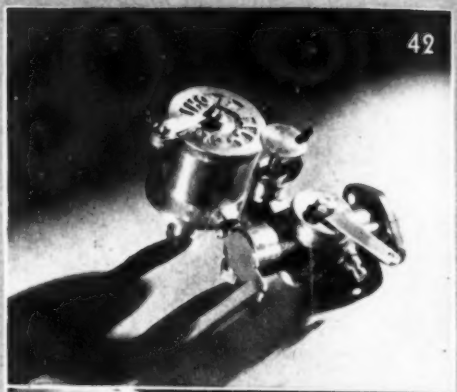


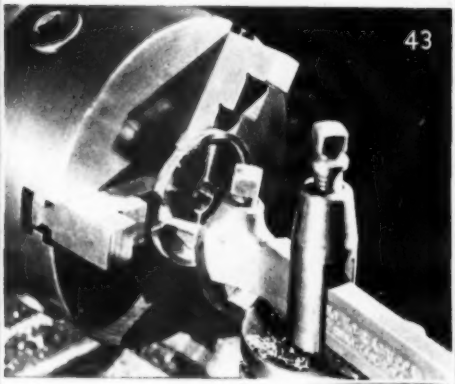
Pistons and connecting rods are added (above). Flywheel shown below; carburetor in Photo 40.









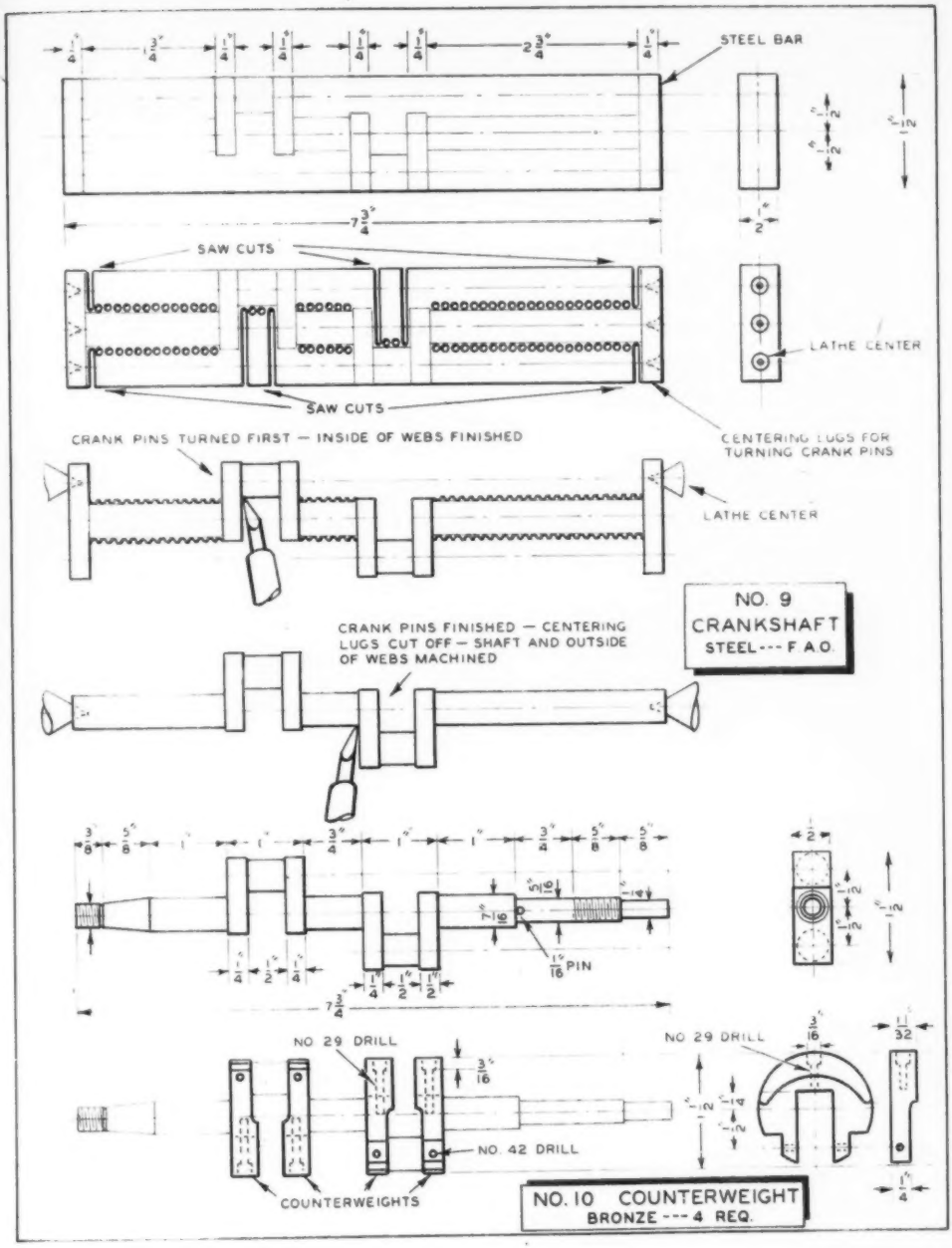


In Photo 41 are the completed carburetor parts, assembled in Photo 42. Other photos show timer.

indicated in the drawings. The open ends of the weights are pinned in place with the pins well riveted over. With the four counterweights securely fastened in place, the crankshaft is mounted again between centers, as in Photo 35, where the counterweights are turned accurately to their correct diameter. The finished crankshaft with the weights turned to size is shown in Photo 36, while in Photo 37 the connecting rods and pistons are attached and unit is ready to install.

The flywheel is a simple lathe job but care must be taken to have it an accurate one. It can be rough-turned while held in the three-jaw chuck, as in Photo 38, and brought to within several thousandths of final size while mounted on a mandrel. After reaming the hole with the Morse number 1 taper reamer, Photo 39, it can be fastened in place on the crankshaft and mounted between centers where a very light cut is taken across the face and sides of the rim to insure its running dead true.

The carburetor used on this model is the last word in design, being the result of much experimenting with many different types, and has been found to give exceptionally high speeds and a steadily running motor. It is made from four main castings and quite a number of smaller parts, all shown clearly in the drawings. The carburetor may look a



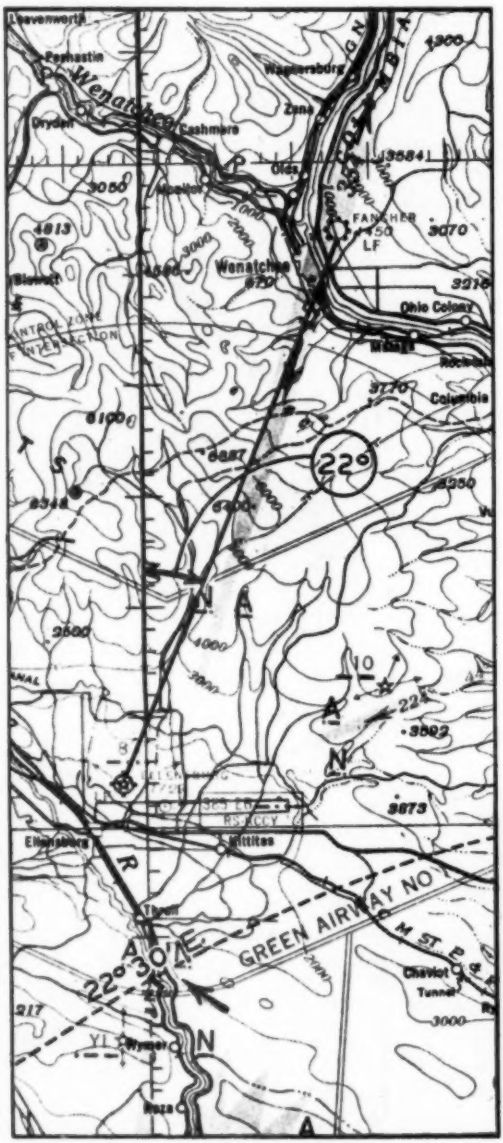
little complicated at first, but careful study will show how each part is made and how the finished carburetor works. The casting for the gas chamber can be bored by chucking as in Photo 40, and the cover can be turned to fit while held with the chucking lug cast on for that purpose. The carburetor body can be machined in the four-jaw chuck where the flange is faced and the tapered hole drilled and bored. The throttle is a straight turning job made to fit the hole in the body. The [*Continued on page* 142]

THE SCHOOL SHOP

Conducted by Gilbert Paust

Lieutenant, Civil Air Patrol, Westchester Squadron

Lesson 11—Solving the Drift Problem



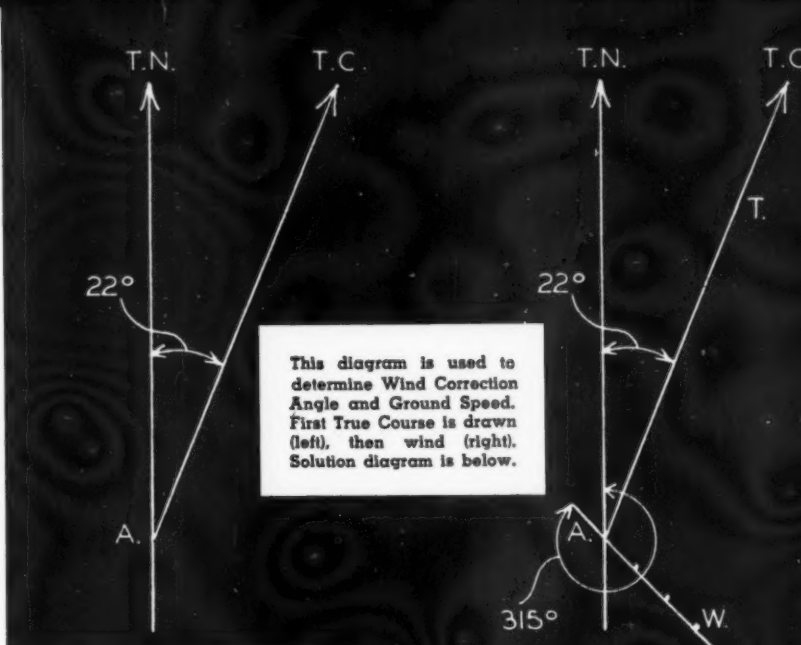
Problem in the text refers to this Sectional Chart.

THIS is our final lesson on Navigation before we "take off" on the equally important subject of Meteorology. I'm sure you will agree that the previous lessons have not been very difficult, but just to make sure that no one has "ground looped" because of Lesson 10 last month, we are going to review Dead Reckoning by means of an actual Navigation problem, at the same time learning a few more interesting points about our old friend, the Wind Correction Angle.

Before plotting the course of our imaginary trip, there is one small item which demands our attention, and that is the subject of *ground speed* and *air speed*. Air speed is the speed of the air past the wings of the plane in flight; ground speed is the speed of the plane with reference to the ground. These two are identical when there is no wind blowing over the ground, but when wind is present, the ground speed of a plane will be a combination of the air speed and the wind velocity.

A difficult idea for beginners to grasp, but an important one nevertheless, is the fact that as soon as a plane leaves the ground, there is no longer any such thing as wind (exclusive of wind gusts and thermal currents) as far as the performance of the plane is concerned. Wind is

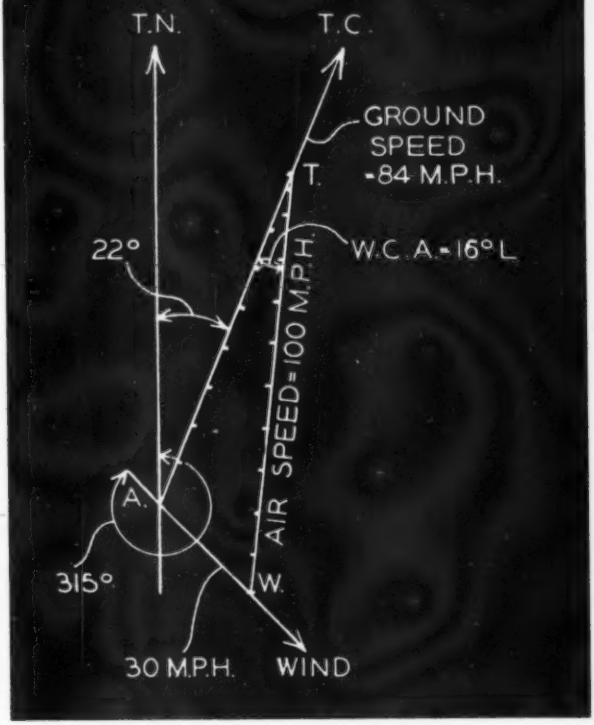
Dead Reckoning is important to Air Corps pilots.

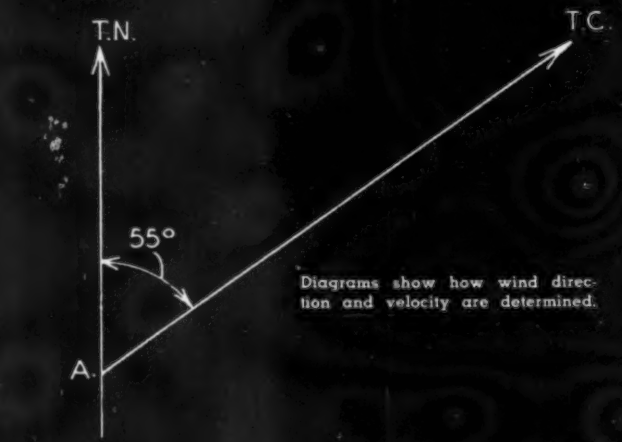


This diagram is used to determine Wind Correction Angle and Ground Speed. First True Course is drawn (left), then wind (right). Solution diagram is below.

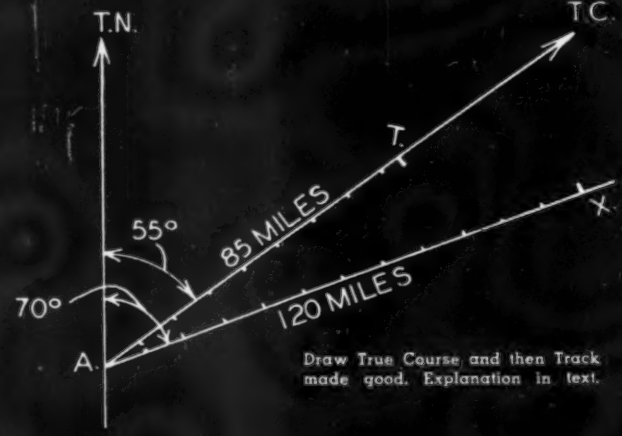
the motion of air across the earth's surface. To illustrate the point, let us take the example of a helicopter taking off vertically from a field in a 20 m.p.h. wind. While it is still on the ground, the air blows by it at the speed of 20 m.p.h. and its airspeed indicator will record 20 m.p.h. even though the helicopter is not moving with reference to the ground. When it rises into the air, however, it will drift with the air and its air speed will then be zero and its ground speed will be 20 m.p.h.

When the pilot adjusts his helicopter for forward motion, therefore, his speed will be measured by the speed of the air past the plane, but his ground speed must also take into consideration the wind velocity. When there is no wind, the air speed and ground speed will be identical. Your plane will always cruise at the same air speed regardless of wind velocity. If the cruising speed is 80 m.p.h. in calm air, it will be exactly the same in a steady wind of *any* velocity. Its rate-of-climb will also be the same. Ground speed is given us by our wind triangle

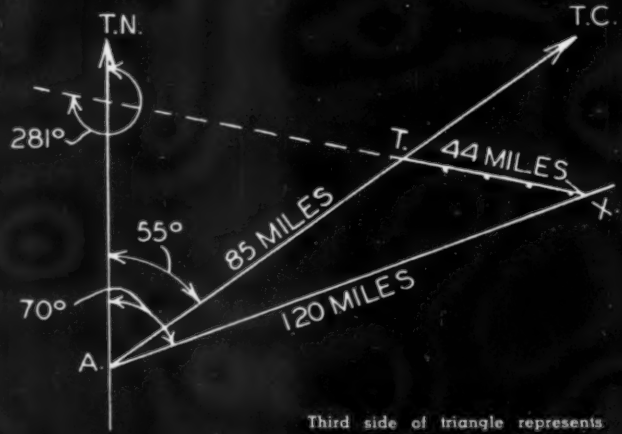




Diagrams show how wind direction and velocity are determined.



Draw True Course and then Track made good. Explanation in text.

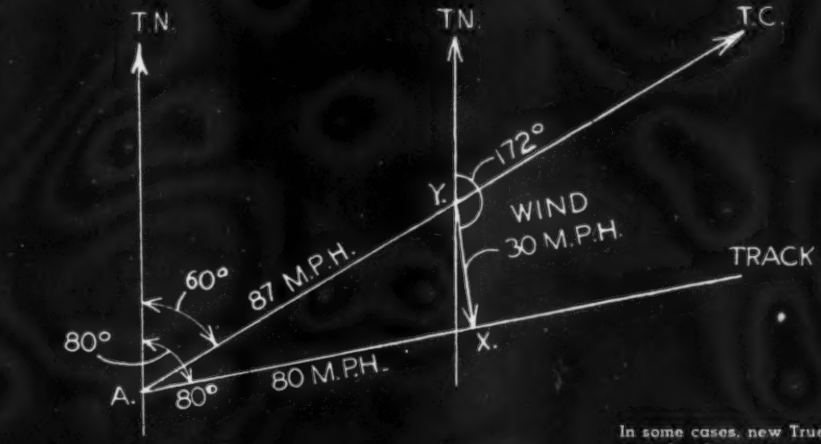


Third side of triangle represents wind causing drift off course.

which we shall consider in a moment.

Now let us proceed to our problem. On page 124 is a portion of a U. S. Sectional Chart of the Midwest. We desire to fly from Ellensburg Airport to Fancher Airport. To determine our True Course, we draw a straight line between the two airports and measure the angle at the nearest meridian by means of simple protractor which can be bought at any five-and-ten or stationery store. Our True Course is seen to be 22°.

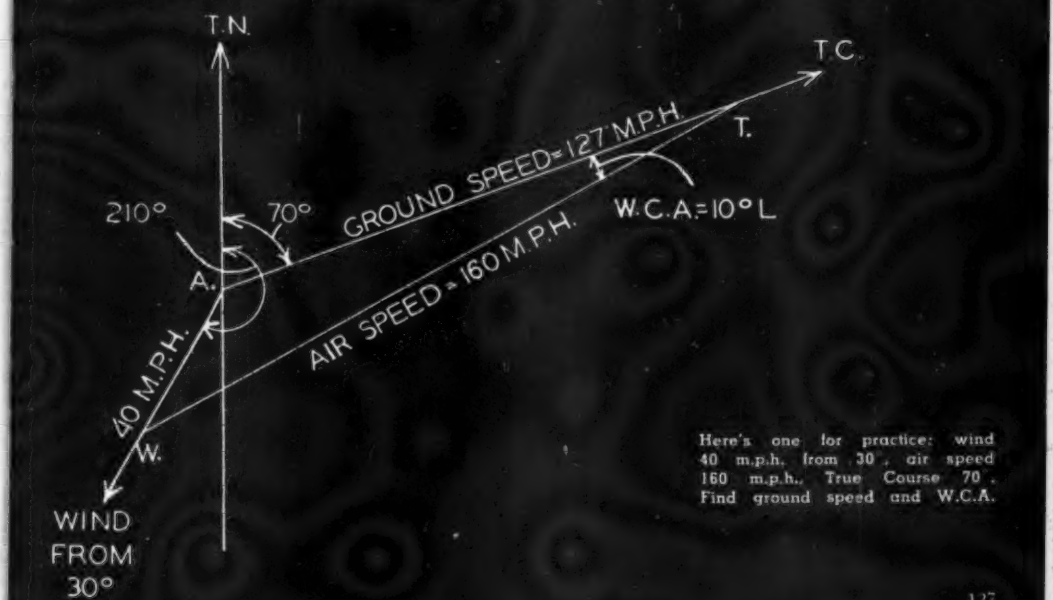
Next we take a piece of blank paper (the larger, the better) and on it draw a True North or meridian line. Choosing a point "A" on this line as our *point of departure*, we reconstruct from it our True Course angle of 22°. From a weather report we learn that the prevailing wind is 315°-30 (30 m.p.h. from 315°) and so from "A" we mark off the angle 315° and draw a wind line in the *opposite* direction, toward 135° (see top of page 125). This wind line must always be drawn in the direction *toward* which the wind blows. Choosing a suitable scale (such as ½ inch representing 10 m.p.h.) we mark off 30 m.p.h. (1½ inches) from "A" on the wind line to the point "W". Let us assume that the cruising speed of our plane is 100 m.p.h., in which case we take our ruler and lay off a line 5 inches long (corresponding to 100 m.p.h.) from "W" to the place where it intersects the True Course line. A drawing compass can be used instead of a ruler if we so desire. We simply adjust the gap of the compass for 5 inches, place the point at



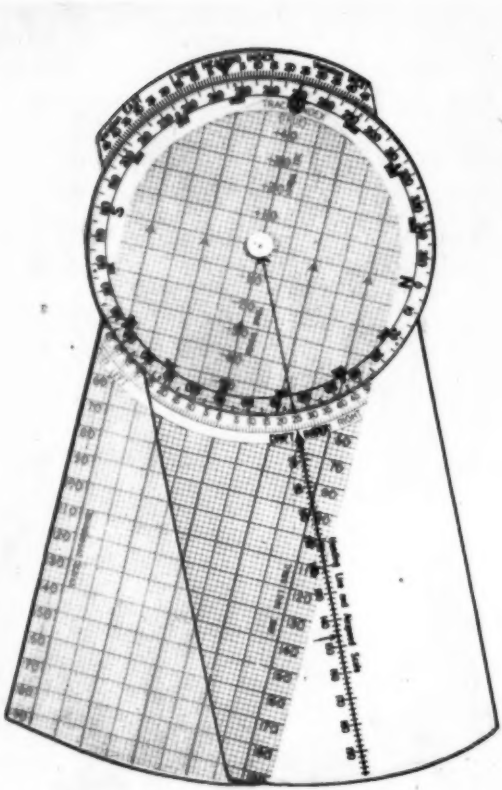
In some cases, new True North line must be drawn to measure wind.

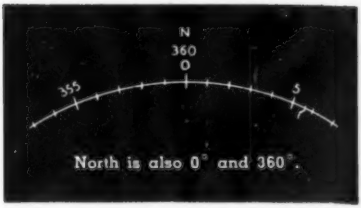
"W" and swing an arc across the True Course line. This point we shall call "T."

Now for our results. Measuring the angle at "T" we find it to be 16°. It is our Wind Correction Angle. Looking at the diagram we see that when traveling from "A" along our True Course, the wind will be from our *left*; therefore this angle will be a *left* Wind Correction Angle. Measuring the distance from "A" to "T," we find that it is a little less than 4¼ inches which is equivalent to



Here's one for practice: wind 40 m.p.h. from 30°, air speed 160 m.p.h., True Course 70°. Find ground speed and W.C.A.





84 m.p.h. on our scale. This is our *ground speed.*

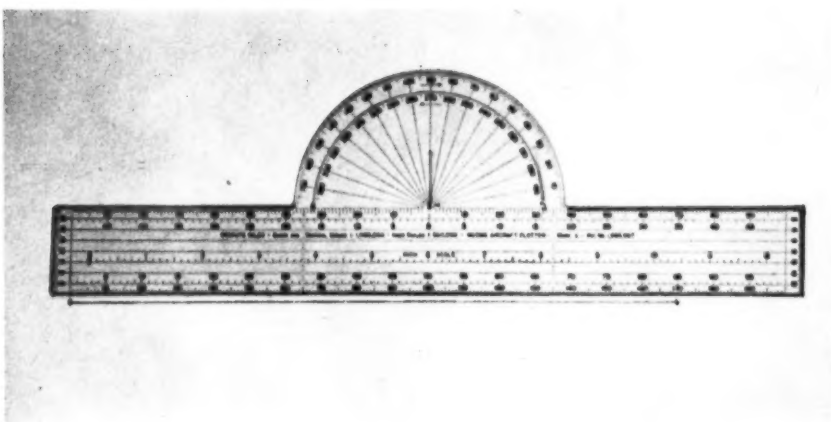
Here we have the "works." Our True Course is 22°. Referring to our chart on page 124 once more, we see that the nearest isogonic line is 22° 30′ East; we'll call it 23° East. This is, of course, our variation.

True Course	22°	
Variation	23°	East (subtract)
Magnetic Course	359°	

How can we subtract 23° from 22° and get 359°? Look at the small diagram at the top of page 128. If we subtract 22° from 22°, we will get North or O° or 360°; subtracting 1° more (to make the 23°) from 360°, we will get 359°.

For Deviation we shall look at the Compass Deviation Card printed in Lesson 10 last month. The card says that for North steer 3 which means that our Deviation Correction for North is 3° West. Since 359° is [*Continued on page* 140]

Computer (above) figures speeds, drift and W.C.A. **Plotter (below) measures angles and distances.**



You'll be on the Greatest Team in the World!

YOU'LL hit 'em *hard* and you'll hit 'em *fast* on this All-American team. You'll fly and fight in planes that were built to scorch the sky. You'll wear a pair of silver wings. And, brother, to win those wings you've got to be *good!*

Maybe you'll be the Bombardier, the fellow who presses the button and "lays the eggs." When your ship is over the target, you'll take charge—and deliver the "knock-out punch."

Maybe you'll be the Navigator, the "quarterback" of the team. With charts and instruments you'll guide your bomber's flight to its objective, and then bring it home.

Maybe you'll be the Pilot. You'll fly a big, powerful bomber or a hard-hitting fighter. With hundreds of flying hours behind you, no pilot will ever be better prepared for the job that's got to be done.

Do you need a college diploma? *No!* If you can qualify as an Aviation Cadet, you will be given five months' training (after a brief conditioning period) in one of America's finest colleges . . . then go on to eight months of full flight training, during which you will receive a $10,000 life insurance policy paid for by the government.

Will you be well-paid after you've won your wings? If you call $246 to $327 a month good pay, the answer is *yes.* And on graduation you will receive an extra $250 for uniform allowance.

How can you qualify to win your Army wings?

If you are 17 but not yet 18 . . . go to your nearest Aviation Cadet Examining Board . . . to see if you can qualify for the Air Corps Enlisted Reserve. If you qualify, you will receive your Enlisted Reserve insignia . . . but will not be called for training until you are over 18.

If you are 18 but under 27 . . . go to your nearest Aviation Cadet Examining Board . . . see if you can qualify as an Aviation Cadet. If you are in the Army, you may apply through your commanding officer.

If you are under 18 (whether or not you have joined the Air Corps Enlisted Reserve) . . . see your local Civil Air Patrol officers about taking C. A. P. Cadet training—also see your High School adviser about taking H. S. Victory Corps prescribed courses.

For complete details—see your nearest Aviation Cadet Examining Board, the commanding officer of the College Training Detachment nearest you or your local Civil Air Patrol.

(Essential workers in War Industry or Agriculture—do not apply)

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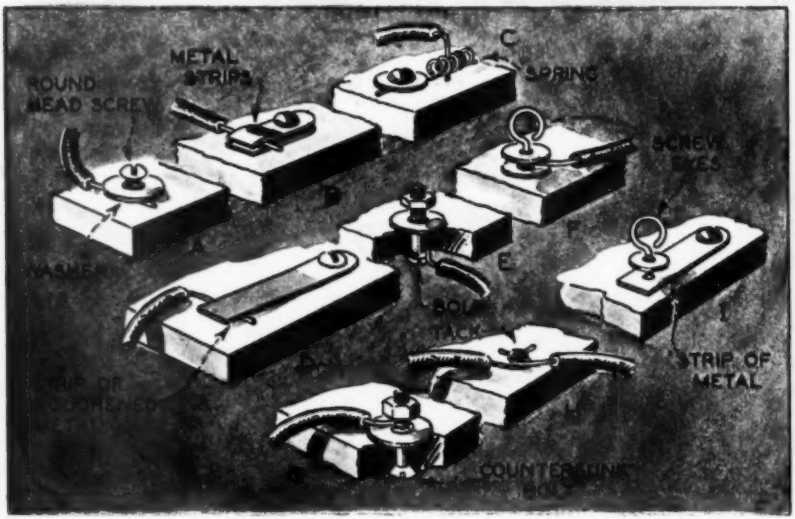
"Nothing'll Stop the Army Air Corps"

"KEEP 'EM FLYING!"

For information regarding Naval Aviation Cadet Training, apply at any Naval Aviation Cadet Selection Board or any Naval Recruiting Station; or, if you are in the Navy, Marine Corps or Coast Guard, apply through your commanding officer . . . This advertisement has the approval of the joint Army Navy Personnel Board.

RADIO WRINKLES



Substitute Binding-Posts

IF YOU wish to replace a broken binding-post or make a substitute one here are nine ways in which one can be made from scrap material:

(A) A round headed screw through a washer. Wire is held between washer and board base.

(B) Two metal strips held tight over the wire by turning a screw.

(C) Wire is inserted between coils of a spring fastened to the base.

(D) Strip of roughened metal. Wire pushed under it.

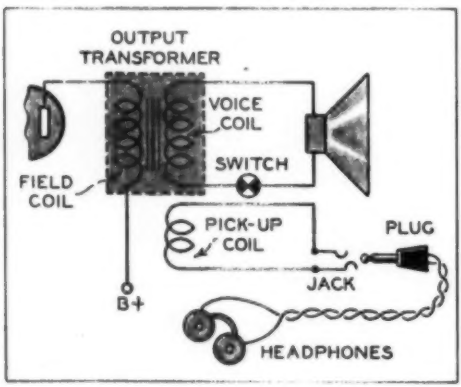
(E) Bolt connected to circuit. Other wire fastens between washer and nut.

(F) Illustrates how a screw hook and two washers can be used.

(G) Countersunk brass bolt with washer and nut. This makes a binding post of the same type found on dry cells, and one which can be worked quickly and easily.

(H) A common tack can be driven down over two connecting wires, as shown.

(I) A strip of metal is fastened to the base at one end. Drill a hole in the opposite end through which is turned a screw-hook with washer. Several wires can thus be electrically connected under the strip.



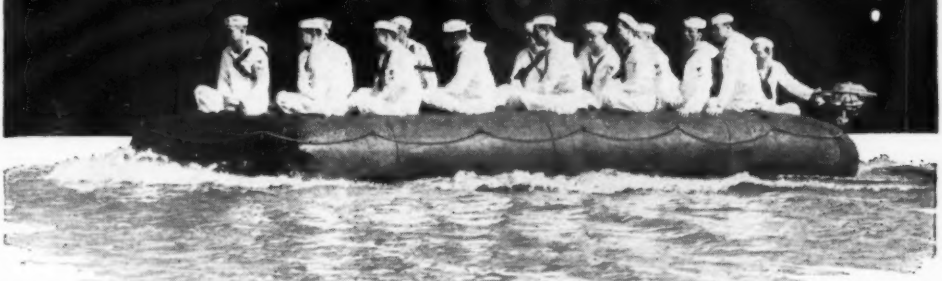
Headphone Pick-up From Speaker Voice Coil

FOR the person who desires to listen to programs over a head-phone and from a radio that has no head-phone jack, the following simple idea can be employed.

Cut one lead from the output transformer to the speaker voice coil and insert a switch. Then couple a coil of several turns of fine wire parallel and close to the axis of the voice coil, as indicated. This can be wound over the voice coil itself or supported close to one end as may be easiest [*Continued on page* 140]

"Ridin' high, wide, and handsome"

in rubber boats powered with Evinrudes!



On many fronts . . . in many ways . . . large, capacious rubber boats serve our Navy and Marine Corps. Before launching they are compact "packages", easily handled, stowed, transported. Quickly the hulls can be unfolded . . . swiftly their compartments are inflated to plump buoyancy . . . motors are secured on special stern brackets . . . and they're set to go!

In a brief period a fleet of them can be readied for duty. With load capacity of several tons, they are used for rearming and refueling operations at advance bases. In landing operations, such a boat carries eighteen men, battle equipped, through heavy surf and over coral reefs. Highly maneuverable and amazingly light in draft, they can be operated in shoalest waters. They are driven by powerful, full-reversing Evinrude "Lightfour" motors, specially developed for this service.

To meet the varied requirements of amphibious warfare on every front, Evinrude engineers have perfected numerous new developments and applications of outboard power, many of which have advanced the peacetime outboard motor into new fields of usefulness. Today these developments — and every motor we build — belong to America's armed forces. *After Victory* they will be yours... for your greater enjoyment of every hour on the water!

EVINRUDE MOTORS, *Milwaukee 9, Wisconsin*

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EVINRUDE

OUTBOARD MOTORS

★ ONLY FIGHTING DOLLARS COUNT . . . BUY MORE BONDS

Victory Saw Table

[*Continued from page* 99]

to the right side of the table top, in the position shown, to act as pivot bearings for the fence guide (part 10).

The sub-top (part 2) is a frame constructed of ¾"x5" front and back members and approximately 3" side members. The back members should project 2" outside of the side members to form a bearing surface for the depth adjusting lever assembly (part 5). This sub-top need not be as wide as the main top, the only requirement being that it be wide enough to clear the saw mandrel mount (part 4). The depth of the sub-top should be the same as the main top, or slightly deeper, so that the trunion supports (part 7) may be mounted in position to receive the semi-circular trunions (part 8).

The base (part 3) is constructed of ¾" stock. The only requirement being that it be made the same size as the sub-top to which it is hinged by means of heavy removable-pin door butts. Screw ⅛" angle brackets to the sides at the approximate position shown to take the depth adjusting lever assembly (part 5).

The saw mandrel is a ½" shaft threaded for a distance of 2" on one end. (A ½" die for threading the shaft can be purchased in most 5 and 10c stores for 15c). The saw is held between two nuts tightened securely against the unthreaded portion of the shaft. A third nut may be added for safety. On the opposite end of the shaft, which should be about 15" long, a 2" pulley for a V-belt is affixed. The bearings are ordinary pillow blocks. Collars are placed on the shaft, bearing lightly against the inside of the pillow blocks, to prevent the shaft from shifting. The mandrel is attached to the mount with lag screws.

The mount (part 4) is made of 2"x4" stock, and for the sake of appearance may be sheathed with ¼" masonite or any available thin stock. It is best to build this mount after the table has been completed so its height will provide maximum projection of the saw above the surface of the main top. This assembly is fastened to the base (part 3) by means of screws through the bottom of the base in position so the saw blade will be at the center of the saw opening in the main top.

The depth-adjusting lever system (part 5) is simple. As shown in Figure 1 it is necessary only to push down on the front cross member of the lever assembly to raise the sub-top and main top to any desired height and thus regulate the height to which the saw blade projects above the main-top surface. The lever is locked in position by tightening the hand nut on the bolt passing through the slot. The adjusting lever assembly is composed of 3 pieces of ¾"x2" stock with triangular braces at the corner under the front cross member and short uprights with rounded tops at the rear ends of the side members. It is hinged to the base (part 3) by means of 3/16" bolts passing through holes in the side members at the position shown and through the angle brackets. The rounded uprights bear on the projecting ends of the rear cross members of the sub-top (part 2).

The lock for the adjusting lever assembly is constructed by cutting a 5/16" slot in a ¼" strip of plywood 2" wide and approximately 10" long. Two holes are drilled ¾" from the top end. These holes are slightly larger than the screws which will be used to fasten the lock to the base as the line of travel of the front cross member of the lever assembly describes an arc and therefore a slight play must be allowed in the lock. A ¼" carriage bolt passes through the slot and through the hole in the front cross member of the lever assembly. Tightening the hand nut effectively locks the lever in any desired position.

The trunions which permit tilting of the main top (part 3) are constructed of ¾" x 10" stock. A 10" circle is cut and then sawed across its diameter making two equal semicircular sections. A slot describing a 45-degree arc 5/16" wide is cut 1" from the edge as shown in Figure 2 (part 8). A ¾" x 2" strip is screwed to the top face of each on opposite sides to make a right-hand and left-hand pair. In screwing these trunions, to the under side of the main top, one at the front, and one at the back, it is important to see that the center of the trunions are coincident with the line of the saw blade; i. e., on a line through the center of the cutout in the top.

The trunion supports (part 7) are also made in pairs. Four pieces of the same size are cut with a 45-degree cutoff on one side as shown in Figure 2. An arc is drawn using one of the semi-circular trunions as a guide, and this arc is cut out of two of the pieces. One of the pieces from which the arc has been cut is screwed to one of the pieces without the arc; the two remaining pieces are similarly assembled but oppositely. This forms the pair of supports for the semi-circular trunions. A hole is drilled through the support coinciding with the center line of the 45-degree arc slot in the trunions. The supports are screwed to the sub-top in the position shown in Figure 1 forming a seat for the trunions. Triangular braces are added to give additional rigidity. These are glued in place. Carriage (¼") bolts pass through the holes in the supports and the arc slot in the trunions. Thus the main top may be tilted to any desired angle up to 45 degrees, and is locked in position by tightening the wing nuts.

The ripping fence (part 11) is made of ¾" stock. The vertical fence member is 2" wide and the horizontal member to which the vertical member is screwed is 3" wide. The end heads are 3" wide and are screwed at right angles to the fence proper, the distance between them being ⅛" more than the depth of the main top (part 1). The simple fence locks consist of a spacer block

[*Continued on page* 134]

"HOME WOULDN'T BE HOME WITHOUT A HARLEY-DAVIDSON"

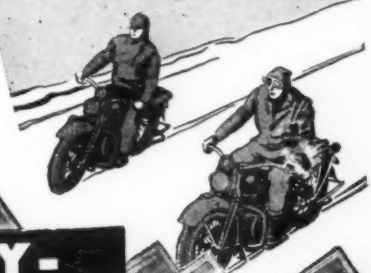
A LAD in our Armed Forces wrote us this letter:

"My job is motorcycle inspecting. Harley-Davidsons are sure doing a swell job in the Army. You wouldn't have to ask why, if I could take you with me on one of my test rides. There's where Harley-Davidsons show what they've got.

"I sold my Harley-Davidson when I entered the Armed Forces, but you can bet your bottom dollar that one of the next new Harley-Davidsons after the war will be mine, because home wouldn't be home without a Harley-Davidson."

That letter makes one of the best advertisements ever written about the dependable performance of Harley-Davidsons. All we can add is — "Put your fighting dollars in War Bonds and *own* a Harley-Davidson after Victory is won!"

Mail the coupon today.



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Dept. MI, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

SEND COUPON NOW

Name.....

Address.....

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FREE!

Victory Saw Table

[*Continued from page 132*]

screwed to the under side of the fence heads, and a longer free block which extends 2" beyond the inside edge of the spacer block. A ¼" thick filler is nailed to the longer block extending only to the inner edge of the spacer block. Some ¼" carriage bolts passing through 5/16" holes drilled through the fence, spacer-blocks, and long blocks form clamps which lock the fence to the front and back edges of the main table top. Hand nuts are advisable to tighten the clamps as the fence is used so frequently, and hand nuts are much more convenient than wing nuts.

As some clearance must be allowed between the ripping fence heads and the table edge, some means must be used to assure the fence being parallel with the saw plane. For this purpose the well-known parallel arm principle is used to advantage (part 10). Care must be taken that the dimension between the bolts which fasten the cross member to the arms is exactly the same as between the holes in the brackets which are attached to the right side of the main table, and the arms must be exactly the same length measured from the center to center of the bolts which hinge them to the cross member and the bolts which pivot in the brackets. In operation the guide is pushed against the fence and as the cross member of the guide will always remain parallel with the saw plane, the fence will also be parallel. Note that no nuts are used on the bolts which pivot the guide to the brackets. This enables the guide to be quickly and easily removed so the fence can be drawn off the back of the table when crosscutting is to be done.

The arm of the mitre gauge (part 12) is of ¾" stock and of a width to "slide fit" the 1½" groove in the main top, and approximately 20" long. The head is made in a similar manner to the semi-circular trunions but is shaped as shown in Figure 2. A ¾" x 2" fence is screwed to the edge. The head pivots on a 3/16" bolt passing through the arm and through a hole in the head at the center of the circle the radius of which determines the arc slot cut in the head. Calibrations can be made on the edge of the head and an index pointer screwed to the arm. Tightening the wing nut, of course, locks the head in any position for making crosscuts at any desired angle. Legs may be made of 2" x 4" stock and attached directly to the base of the table, or a separate bench may be used and the motor mounted at the back of the saw on the bench.

Attempts are being made to introduce abaca, or Manila hemp, to the American tropics.

A number of the chemical elements do not occur free in nature, but only compounded with other elements.

The highest accident rate is among persons 65 years and older.

"Dodging" With Lights

[*Continued from page 85*]

the effects when you hold your hands in front of the light and move them about to shade different portions of the scene. Do this with all lights that are spreading too far.

Annoying shadows can be eliminated by shading the areas around them so that the surface against which they fall will be an even shade of gray. A shadow shows up because of the light surrounding it, and if this light is masked off, the shadow will disappear. Even spotlights, which throw concentrated beams of light, can spread too much, and cardboard masks should be used on them in the same manner when this occurs.

Before tripping your shutter, make a final check-up to be sure that no light has spread to unwanted areas. The masked-off portions of your picture will come out weaker in the negative than the other portions and will therefore print in darker and more subdued tones. The effect, however, will be more realistic than if these portions were "burned in" during enlarging.

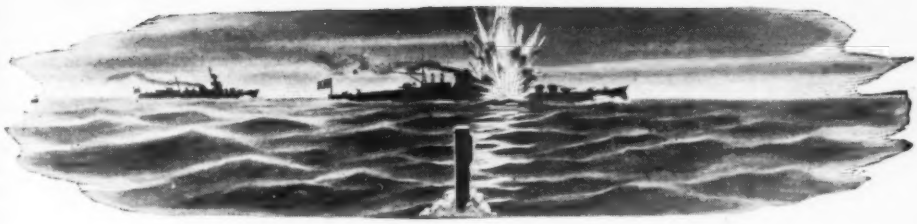
The photos on these pages show the effects obtained with and without cardboard dodging. Each setup was carefully illuminated and cardboard masks were used to control the lights. After each picture was taken in this manner, a comparison shot was taken of the same setup with the same lighting but with all masks removed. The differences readily can be seen in each case.

In the first pair of illustrations, Photo 2 was taken without dodging masks. The white shirt and the bed covers receive the same brilliant illumination as the subject, giving a flat and uninteresting lighting effect to the picture. In Photo 1, however, which was taken with the same lighting arrangement, these portions were shaded with masks and only the center of interest was allowed to receive full light intensity. As a result the picture has more punch, a better three-dimensional effect, softer lighting, and an elimination of harsh shadows. The second pair of illustrations show similar differences in their respective effects.

One thing to remember when shading your lights is that you are cutting down the light intensity and your pictures will therefore require an increase in exposure of from two to four times, depending on how much of the light you've held back. Expose for the brightly lighted center of interest and not for the shaded portions of your picture. The resulting negative can then be tossed into the enlarger and an enlargement made with nary a finger lifted for dodging purposes.

Finishes that will make silk stockings resistant to snagging and abrasion are a goal of laboratory experiments.

Although quinine is native to South America, 90% of the entire world supply of this valuable drug is either grown in the Netherlands East Indies or distributed through Dutch interests.



HERE'S YOU IN A SUB

Like to take a good crack at a German or Jap warship—personally? Then look at the illustration below.

There's a place for you there—right inside a U. S. sub.

Of course you can't be there actually and physically. But you *are* represented.

The bonds you bought paid for that periscope.

The goods you conserved, the scrap and fats you saved, helped to release that torpedo to do its deadly work.

Your blood may save the lives of members of this *very* crew.

You can make this sub, or any other fighting unit, more effective. Buy more Bonds . . —conserve and save . . . —give blood . . . —the more you do, the sooner you'll enjoy the richer, fuller life that's coming for us all when this war is over.

For example: Are you a camera enthusiast? Universal promises finer-than-ever cameras easily within your means, new thrills in picture-making . . . thanks to new feats of engineering achieved in furnishing the Army, Navy, Marines and United Nations with fine precision optical equipment.

And other manufacturers, in other fields, are bursting with similar promises for *their* after-Victory products, eager to bring them to you soon.

But first, let's all take our places in that sub—today!

There's only one flag we're prouder of!

UNIVERSAL CAMERA CORPORATION

NEW YORK • CHICAGO • HOLLYWOOD

Makers of Precision Photographic and Optical Instruments • Peacetime-Manufacturers of Cinemaster, Mercury, Corsair Cameras

Basket of Apples

[Continued from page 101]

A round-nosed scraper is the best chisel for this, though a diamond point may be used. The hole should be about 1⅜" deep and ½" to ¾" in diameter.

Next, remove the block from the faceplate and place between centers, with the live center against the opening and the dead center against the top end of the shaker. Shape the apple form between centers, hollowing out the top end slightly to give the true apple shape.

With the apple still between centers, do the sanding and finishing. A clear lacquer finish applied in the lathe, followed by a coat of good wax, gives a hard, smooth, high gloss to the shakers. Remove the finished shakers from the lathe and knock off the thin dead center plug. Drill a hole in the center for the basswood stem, which is hand-carved and stained dark. Fit a small section of cork into the bottom, or use a wooden plug. Bore four holes in the top of the apple for salt or pepper outlets. Remember that the pepper holes should be smaller than those for the salt.

The recesses in the basket present an interesting problem in off-center turning, but if carefully measured, should present no difficulty.

Glue a 5" disk of walnut to waste wood of the same size, with a piece of brown wrapping paper between the two disks. Mount on the faceplate and turn the outside and inside of the basket base.

To cut the recesses, remove the metal faceplate, locate the center of the waste wood and measure half the distance from it to the outside edge. Mark this center point and use it as the center in remounting on the faceplate. Turn a shallow recess in the bottom of the basket, just large enough in diameter to accommodate the base of the shaker. The second recess is cut in the same manner, with the faceplate fastened to the opposite side of the waste wood.

The handle is turned from a 4" disk of walnut. Round off the outside edges, then cut down through the disk of wood, leaving a ¼" ring. Saw off one-third of the ring, leaving the other two-thirds for the handle. The handle is attached to the base by means of wood pegs glued into holes in the handle, and corresponding holes in the basket base.

The basket base can be removed from the waste stock by tapping the faceplate with a hammer. The paper separating the two pieces of wood will tear and allow the waste wood to fall off. The little paper that is left on the base of the basket can be dampened and scraped off, or it can be removed by sanding.

If the shaker basket is to be used on a bare table, it is best to glue a piece of felt to the bottom, to avoid any danger of marring a polished surface. —*Elma Waltner.*

Chemists explain that soap is added to most automobile greases to give them the oiliness and staying power which they do not possess naturally.

Cotton yarn used in airplane fabrics, typewriter ribbons and fine dress goods is so fine that it takes 50 miles of yarn to make a pound.

Horse Race Can't Be "Fixed"

[Continued from page 111]

onto the floor, the horse for which it was intended will fall out of the race early.

The revolving arms rest on steel disks welded or brazed to the axis, and are caused to turn by spinning the knob on top of the track in the center. Inasmuch as friction alone makes the arms revolve, some skill must be applied to turn the knob at the right speed, adding to the hazards of the race, for if the knob is spun too fast at the start, the disks will slip under the wooden arms, just as a locomotive spins its wheels if the engineer opens it up too wide at the start with a heavy load. On the other hand, if the knob is spun slowly at first and gradually speeded up, the arm with the ball at the outer hole will tend to throw it out by centrifugal force, because the holes are relatively shallow, thus losing that advantage.

Make the box of ½" material with wood cleats all the way around, near the top, upon which the race track is to rest. The latter can be lifted out by taking hold of the Judges' Stand and the arch across from it. These arches should be made of scrap plywood at least ½" thick, but if sufficient scraps of that material are not available, glue two pieces of ½" material together with the grain at right angles and scroll-saw as indicated. The arches must be plenty strong because they carry the load of the marble-alleys which are screwed under the center of the track. Cut the horses from tin and solder to the sheet metal supports, then bend them to a curve on the same radius as the slot in which they travel. This enables them to clear the narrow arches, and also gives them the effect of more speed.

Inasmuch as there are only two horses, one for each player, the betting is done instead on the jockeys, or steel balls. The slots in the Jockey Clubs are labeled, respectively, Tim, Tom and Ted, and Jim, Jack and Jerry—or names of one's own choice. The slots being so much larger than the balls it is not probable that the latter will follow the same course twice in succession, as the variable human element enters here, a tiny fraction of an inch to the right or the left of where the ball was inserted before will most certainly alter the outcome of the race. The winner, of course, is the one who travels the farthest and the start is always made at the Judges' Stand, since this brings the revolving arms in register with the holes in the alley.

Paint the race-track area green, the arches and Judges' Stand white, the latter with a red roof. One horse should be black, the other white, and the jockeys' jackets in two different colors.

To retrieve the steel balls, simply tilt the box and they will roll out of the revolving arms to the floor, and thence out the hole in one corner.

Present war tactics are apparently causing more casualties among civilians than among armed fighters, a medical publication reports.

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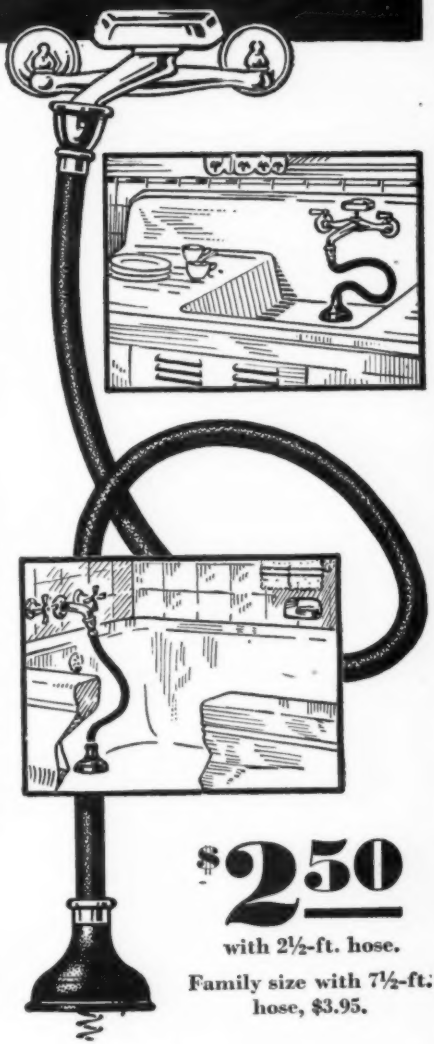

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Steam Turbines

[*Continued from page* 95]

whose blades are impelled, not by steam or water, but by a highly expansive gas carried in liquid form, shot through the turbine as a gas, then recondensed back to liquid, much on the principle of a modern refrigerator. Such an engine would be virtually a self-contained unit, seldom needing refueling.

Whatever the future of the turbine engine, it is today one of our chief weapons for winning the war; without its whirlpool of power our ships, factories and generators could not operate and our soldiers and supplies could not be moved to the fighting fronts.

A new sound movie entitled "The Magic of Steam" has just been produced for the Allis-Chalmers Co., manufacturer of steam turbines, by the Jam Handy Organization. This picture, available to schools, plants and engineering students, tells the story of the steam turbine and its importance to the war effort. MECHANIX ILLUSTRATED recommends it highly, and will be glad to supply further information regarding it upon request. Address MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, N. Y. Please enclose return postage.

Inlaid Jewel Box

[*Continued from page* 102]

determine the correct angle at which to set your saw table. When you have a tight fit using the scrap wood, you are ready to proceed with the box top. Set the drill press table at the same angle as you have the saw table and drill a hole through the two thicknesses of wood. Use a drill that is just large enough to allow the smallest saw blade to pass through, and drill at a corner of the initial.

Pass the blade through the hole and saw out the initial. The maple letter should fit snugly into the cutout walnut letter. Set it in place with glue, and glue the inlaid ½" disk to the other disk. Fill the hole where the saw blade passed through with a putty made of walnut sawdust and glue. This will be invisible when turned and polished. Glue a wood faceplate to the top of the turning block, covering the initial.

Mount the lower half of the box on the faceplate. Turn out the box cavity and a lip to hold the top lid. Then mount the lid block on the faceplate and turn out the top of the box cavity making the lid a friction fit on the lip of the box. Remove the wood faceplate from the box lid.

Remount the closed box on the faceplate and proceed with the outside turning. The friction fit of the lid will keep it in place for turning and polishing the top of box as well as the sides. Finish the outside of the box while it is in the lathe, using a French finish.

Ideas For Service Men

[*Continued from page* 100]

the course of our peregrinations, many hopelessly soiled service ribbons, we think a lot of you lads well might follow the brainstorm of this anonymous young tar. The cellophane is folded over the ribbon and fastened on the back with a bit of Scotch tape. Very simple and effective.

Why Not Whittle It?

[*Continued from page* 113]

knife strokes give a hand-carved appearance which will add to its charm.

A few more well placed strokes will finish the carving; put a groove around the eyes to give them shape and size, and cut wrinkles in the brow. Then it is ready to be colored.

Water color applied sparingly with a camel's hair brush is good for this. Make the tip of the nose and the eyes black. The ears may be dark brown, almost black, and the tongue bright red. A few random light brown spots on the body will complete the job. When the paint dries coat the whole dog with clear varnish or clear shellac and he will delight anyone who gets him for a Christmas present.

You can use this same method in making other figures in which you may be interested.

Homemade Surface Gauge

[*Continued from page* 115]

also fit the ¼" hole in the block B without play, therefore it is as well to turn this a little oversize, finishing up with a file and emery cloth with the lathe running at a fairly high speed and testing in the block frequently.

The scriber can be made from a 7" length of ⅛" drill rod shaped as shown with the ends sharpened and hardened. A steel knitting needle of suitable size also makes a good scriber. One end should be heated and bent as shown in Fig. 4, after which it can be reheated and quenched in cold water to harden and the points ground up on the emery wheel.

The addition of the small coil spring F, Fig. 1, completes the making of the tool. This should be fairly stiff, about 1" long and ½" diameter. It is placed over the adjusting screw E bearing on the lower side of the plate C. The lower end rests in the ½" hole countersunk in the base to receive it. The manipulation of the screw E in conjunction with the spring permits a fine adjustment of the scriber.

For marking off operations on small castings and other parts, a piece of heavy glass of suitable size cut from an old auto windshield makes a first class surface plate for use with this gauge.

China's small cooperative workshops turn out light supplies, such as leather helmets, bandages and shoes in the front line areas of fighting.

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[*Continued from page* 128]

close to North, we shall use that correction. Continuing our solution:

Magnetic Course	359°	
Deviation	3°	West (add)
Compass Course	2°	

Referring to the diagram on page 128 once more, 359° plus 3° is 362°, but since 360° is also 0°, our answer will be 2°.

Compass Course	2°	
W. C. A.	16°	Left (subtract)
Compass Heading	346°	(362° minus 16°)

Now we can climb in our plane, set our course for 346° by compass, and eventually reach Fancher Airport. How long will it take us? The distance between Ellensburg and Fancher on our Sectional Chart on page 124 is 3.1 inches which is equivalent to 31 miles (using the Sectional scale of 10 miles to 1 inch). Our distance of 31 miles divided by the ground speed of 84 m.p.h. is .37 hours or 22 minutes (.37 x 60 minutes), the time of our trip.

Let me call your attention to one important fact that we can see on our Sectional Chart. We shall have to pass over elevations greater than 6,400 ft. (shown by the contour lines), and this means a cruising altitude at least 500 ft. greater.

Drift Angle enters into Dead Reckoning in the solution of a problem such as this: A pilot is flying on a Compass Heading of 65°. His Variation is 12° West. What is the True Course being followed? From the "steer" column for 61° (closest to 65°) of the Compass Deviation Card, we see that the Deviation correction is 1° West. In solving our problem in reverse (from Compass Heading to True Course) we reverse all rules, *adding Easterly and subtracting Westerly*, and adding a Right Drift Angle and subtracting a Left Drift Angle. The Drift Angle in this problem the pilot determines from his Drift Sight; let's say it is 20° Left. Here is the solution:

Compass Heading	65°	
Deviation	1°	West (subtract)
Magnetic Heading	64°	
Variation	12°	West (subtract)
True Heading	52°	
Drift Angle	20°	Left (subtract)
True Course	32°	

Referring to his chart, he can see where a 32° course is taking him.

When a pilot drifts off course because he has not allowed for wind, he can determine his wind velocity as follows:

First he draws a True North and lays off his True Course from the point of departure "A" (page 126). Let us assume that in this particular problem the True Course is 55°. By looking at his map and determining his present position on the earth's surface, he can measure the angle of his Track (actual path over the earth's surface) and also the distance he has drifted from "A" in one hour. The Track he finds to be 70° and the distance 120 miles. This Track and the distance to scale he also lays off from "A" as shown. His air speed he knows is 85 m.p.h. This means that if there were no wind, he would be at "T," 85 miles from "A," in 1 hour. If he lays off 85 miles according to scale from "A" and draws the line "TX," this line will represent the existing wind direction and velocity. From his scale he finds that the wind line is 44 m.p.h., and extending the wind line back to the True North line and measuring the angle, he discovers that the wind is from 281°. Remember that wind direction is always given as the direction FROM which the wind is blowing! If it is impossible to extend the wind line to meet the True North line (as at the top of page 127), a new True North must be drawn through "Y" parallel to the original True North. The direction of the wind arrow can be determined easily by considering in what direction the plane has been drifted off course.

This finishes the series of lessons on Navigation. The Question Box which was promised you for this month unfortunately must be postponed again because of lack of space, but it will be with you definitely next month and will be on Navigation even though the lesson itself will deal with Meteorology. In January MECHANIX ILLUSTRATED the first Meteorology lesson will be No. 12—*Clouds*. Be sure to reserve your copy!

This series of lessons is for the benefit of aviation instructors, cadets, preflight students and others interested in aviation. When complete, it will furnish a complete text on the subject. Save all the material for study and future reference.

What do you think of these lessons? We will welcome any criticisms or comments you may have in regard to them. Address your mail to: Aviation Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, N. Y.

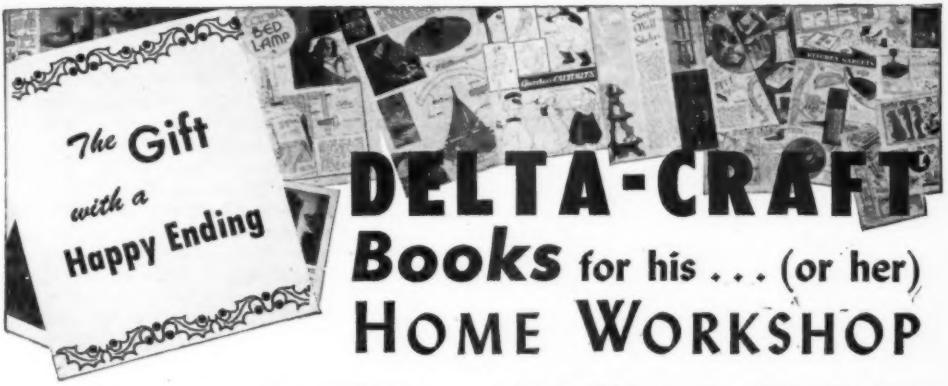
Headphone Pick-up From Speaker Voice Coil

[*Continued from page* 130]

to do. Continue leads from this pick-up coil down to a suitable open circuit jack. Thus, no part of the circuit has to be changed to the receiver.

When headphones are desired, the speaker can be cut out of action by opening the switch. Then plug in the phones and listen without disturbing anyone else.—*L. B. Robbins.*

A new use for the photo-electric cell, or electric eye, is to cut bread wrapping paper at exactly the right distance from the printed design to make a neat package.



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"Mariner Junior" Engine

[*Continued from page* 123]

various other parts all are made up to dimensions set out in the drawings and shown complete in Photo 41, while in Photo 42 they are assembled and the finished carburetor is ready for use.

The distributor and its numerous parts were made up from the two main castings and the stock called for in the drawings. The distributor cap is of bakelite while the rotor is of hard rubber. The breaker arm with contact points is the regular full-size automobile type available at auto supply stores. There is a small chucking lug on the casting for the distributor plate which makes machining an easy matter when chucked as in Photo 43, where the inside face and outer rim are turned to size and the center hole drilled, leaving nothing but the back of the casting to be smoothed up.

The timer body can be bored while chucked, as in Photo 44, and the balance of the work done on the drill press and by hand filing. This is shown complete with the breaker arm in place, Photo 45, along with the finished distributor plate. When the distributor cap has been made up it can be screw-fastened to the plate after the rotor has been made and is in place. The steel cam is turned from bar stock and filed to shape by hand, closely following the dimensions in the drawings. It should be drilled for a force fit on the shaft, and when the motor is assembled, driven in place with the distributor mounted directly aft.

This completes the various parts. When they are all assembled and working smoothly, the flywheel is turned over slowly by hand and the motor is timed as accurately as is possible before any actual tryout. The wiring diagram shows how the little power plant is hooked up. A gas tank is connected to the carburetor and the motor is ready for its first run. For the initial tryout the motor should be securely fastened to the bench with the flywheel projecting over the edge far enough for a narrow belt to be placed over it so a downward pull will turn over the motor against compression. With the electrical system properly installed and the tank filled with high test gas, the engine is all set to go. Close the throttle and the air choke on the carburetor, open the needle valve a turn or two, advance the spark and with the ignition turned on, back up the motor against compression with the leather belt and give a quick spin forward. If your little engine has been built according to plans it will take off at the first spin and from there on it will be a matter of breaking in and fine adjustment to develop its limit of power.

A hand-operated pump sprays alcohol on the outside of plane windshields and cabin windows to prevent ice formation.

Diamonds are believed to have been first discovered in Brazilian gold washings in 1670.

Ocean waves have been known to lift blocks of stone weighing hundreds of tons.

Underground Secret Eye

[*Continued from page* 37]

General Daluege, Heydrich's successor in Bohemia-Moravia, decreed the death penalty for "helping or sheltering a person in possession of photographic equipment, or for carrying illegal photographs." In Prague alone, eleven Czech students, among them five girls, were put to death for "making illegal photographs."

You need steady nerves and quick judgment for the job. You may have to work under the most trying conditions. No time to set up your tripod, to fool around with filters, sun shades, telephoto lenses, other gadgets. You must work during a devastating Allied air raid, in blasted houses, among Nazi stoolpigeons. You have a small, cheap camera which you conceal in your pocket, briefcase, newspaper. You shoot through a hole in a book cover with the center of the pages cut out. Old tricks, known to newspaper photographers everywhere; and brand-new tricks, which can't be revealed.

Two years ago the illegal photographers worked by themselves, unaided. Consequently many were caught and executed. The amateurish every-man-for-himself era is over. Today the Underground Eye works in small, independent units of three or four men and women, like gun or bomber crews. Each member has a definite task. Teamwork increases efficiency and gives them a better chance to remain alive.

The first crew member gets the necessary equipment. That sounds easy but isn't. Germany, home of such pioneer firms in the photofield as Zeiss, Leitz, Siemens, Busch, Agfa, Mimosa, Voigtlander, is desperately short of equipment. Films and papers are faulty; chemicals can be used only once; color-film is unobtainable. In the subjugated countries you have to be a member both of the Party and the *Reichsbund Deutscher Amateur-Fotografen* to get film. Which means that the underground has to hunt for equipment through secret channels.

The second unit member does all the processing, a backbreaking task. You can't afford comfortable, well-equipped darkrooms, where the secret police may break in at any moment. Developing and printing is done under Hitchcock-like conditions. Workrooms have been installed in wrecked railroad cars, in the cellars of bombed houses, in sewers and caves and mountain-hideouts and even in churches. "The most unlikely places are the best," they say. "Once we installed a darkroom in the bathroom of the cook of a Gestapo official. The Nazis never thought that we would dare do such a thing under their very noses. We had to give up when the official and his cook were transferred. Our rule is, 'The more improbable the place, the better the chance of remaining undiscovered.'"

The third crew member does the actual shooting. In the beginning the job was given to pro-

[*Continued on page* 144]

"Good Pictures" bring you to him

1st. Lieut. Bernard Shaw, 28 year old son of Mrs. Veta Shaw, who is serving with the U. S. Army in the South Pacific.

Dear Mom and Mary:

Civilization has long been a dream to us, and when we look at a magazine or pictures from the good old U. S. A. it is like looking at Mars or some far-off, mythical place where all good soldiers go.

I'm not quite up on the local situation, I want to hear about Ann Arbor, Detroit, how people act, think, and what is going on. People at home have no idea how it is not to see a building, a church, a pretty girl for seven long months.

We are not ungrateful, it's just that we always want our World held up before us—it makes it easier to go on.

Love to all,
Bernard

Mrs. Veta Shaw, who kindly allows us to publish her son's letter, is helping him by working on the production front in our Optical Division.

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Underground Secret Eye

[*Continued from page* 142]

fessional photographers gone underground; but they were the first to be rounded up. Now girls are assigned to do the shooting of pictures. Girls have a way of getting away with murder, even as far as the Black Shirts are concerned. Many girls knew how to handle a box camera only and had to be trained for the job.

Some of them are great photographers. They know all about angle shooting, work with infra-red flash bulbs during the blackout, shoot burning objects—a dangerous assignment since bombardiers use fires as targets—have initiative and fine judgment.

Military men have recognized photography as an indispensable instrument of getting correct information. Aerial reconnaissance is imperative for accurate bombing; night photography reveals important troop dislocations. Somewhere in Norway the Nazis have built a carefully camouflaged airdrome, with oil tanks and gun emplacements blended into the landscape. Twice the powerful Stirling bombers of the Royal Air Force came over —and were deceived by a fake wooden airdrome, built five miles south of the real thing.

One day the British were informed by the Norwegian Underground to watch out for a big arrow on the green meadows pointing toward the secret airdrome. Reconnaissance-fliers over the indicated area were unable to see an arrow. One took color photographs which distinctly showed the arrow. From over 11,000-feet altitude the ground looks like a huge map to the human eye, with most color shades fading out; but color photography spotted the slight deviation. Down there a Norwegian Underground photographer and expert in color photography designed the arrow so carefully that it could hardly be seen from the earth. Three hours later Boston and Hampden bombers hit the airdrome.

"All you have to do," a Dutchman said to me, "is to replace the foliage on gas tanks with darker-coloured branches and leaves. Down on earth it's just another shade of autumn's colors; but the multi-lens aerial camera knows better."

There is more evidence that the secret sharpshooters are already operating within the *Wehrmacht*. Soldiers find demoralizing horror pictures from the German home front in their pockets. Official army photographers report the theft of equipment. Filters are broken, films opened and made useless. Small pictures of the German retreat in the east appear in Germany's cities. People who see them cease to believe their newspapers and radios.

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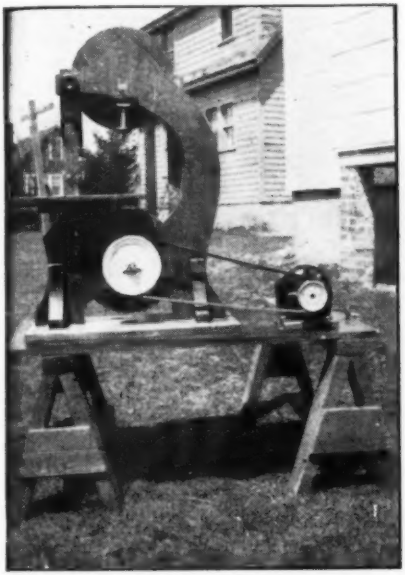
Editor's Workbench Chips

PLYWOOD BAND SAW



This 12" band saw was cut by hand out of plywood. The only machine work on it was for the wooden wheels which have a $\frac{1}{16}$" crown for the saw to ride on. Glued and screwed together, a 2" piece of wood is a breeze for it. Cost $8.00. A $3.00 Workbench award and a Certificate of Merit go to August H. Hislop, 130 Grove Place, West Haven, Conn.

BICYCLE TRAILER

Fifteen-year-old Neale Nesbit, 717 Gephart Dr., Cumberland, Md., rides his dog "Skippy" behind him in this balloon tired, lightly constructed trailer. It is attached to the bike carrier by an easily disengaged hook. "Skippy" loves it, Neale says. He receives a $3.00 Workbench award and a Certificate of Merit.

Dear Jack:

I shot this Indian

while it was getting the works here on the proving grounds. It's an experimental service test model -- a shaft-drive job that's a honey, like all Indian Motorcycles.

The boys who put these machines through their paces tell me they get a real feeling of safety out of the easy way an Indian handles and its ability to stand up under really tough going.

When the war's over, Indian's going to have a motorcycle that'll make your eyes pop. After what I've seen here, I'm going to ride one, believe me!

INDIAN MOTOCYCLE COMPANY, SPRINGFIELD, MASS.

Indian

ARMY (E) NAVY

BUY WAR BONDS NOW

★ ★ TO BUY AN INDIAN LATER ★ ★

ONE THING FOR SALE ... THREE FOLKS TO BUY
AND SO THE PRICE GOES UP SKYHIGH!
WITH PRICES HIGH YOU WANT A RAISE -
THAT STARTS A GREATER SPENDING CRAZE!
UP
UP
UP UP UP
THIS CRAZY WHIRL IS CALLED INFLATION
AND IT ALONE CAN WRECK A NATION!
LET'S ALL STOP PRICES GOING HIGHER
BE A SAVER - NOT A BUYER!

Seven things you should do:

1. Buy only what you really need	**2.** Pay no more than ceiling prices... buy rationed goods only with stamps	**3.** Pay off old debts and avoid making new ones	**4.** Support higher taxes ...pay them willingly	**5.** Provide for the future with adequate life insurance and savings	**6.** Don't ask more money for goods you sell or work you do	**7.** Buy all the War Bonds you can afford – and keep them

Keep prices down... use it up, wear it out, make it do, or do without

This advertisement, prepared by the War Advertising Council, is contributed by this magazine in cooperation with the Magazine Publishers of America.

Bullet-Dodging Handymen

[*Continued from page 56*]

the nose and tail of two other B-17's. One plane returned with a punched-in nose, badly damaged left wing and peppered with flak holes in the forward section of the fuselage. The other had a tail that looked like a sieve. Mechanics cut the two in half and one good Fortress went back to the fighting line.

Many planes have a long record of flying. The "Goonie Bird" in the South Pacific had flown sixty-eight combat missions and had more than 1,300 hours in the air up to last March. She came home once with bomb-hoist cable replacing control cables which had jammed. The bomb-hoist cable, a tough piano-wire, is plenty hard to handle for replacement work, and must have given the crew some bad moments while using it.

A three-year service record by a Havoc A-20 squadron in New Guinea was credited recently by Captain Donald A. Good, squadron leader, to the maintenance section. The oldest ship in the squadron which left the U. S. in 1940, and went into action right after Pearl Harbor, is the Cactus Dan with 562 hours of combat flying. Others have from 400 up to more than 500 hours of combat.

A troop of Servicing Commandoes leaping out of a repair lorry, clutching their Sten sub-machine guns and monkey-wrenches, is a new sight in this war and one worth seeing. To the tank crew in a non-percolating tank, the crew of a grounded airplane, the artillerymen of non-firing guns, the repairman has more glamor than their favorite pin-up girl. He may be covered with grease and his uniform isn't snazzy, but, boy, does he look good along the front line.

Nazi Secret Weapon

[*Continued from page 41*]

(pronounced "Tee-Link") before the war. The Rocket glider had a novel construction, in that the wings folded back into the body of the glider and snapped open after the rocket had been fired. It would be simple to install an electronic device which would control the flight of such a missle. With such a weapon, a Nazi plane could stay outside the range of a convoy's ack-ack, launch its glider-torpedo and direct its flight by radio until it struck the enemy ship. Artist Anderson's picture shows such an attack.

The United States has somewhere near 400 boom towns, as a result of defense industries or nearness to military posts.

A railroad man who has anything to do with transportation must see that his watch varies no more than 30 seconds per week.

BACK THE ATTACK • WITH WAR BONDS

THERE IS NO SUBSTITUTE FOR EXPERIENCE

...in Airplanes or *Outboard Motors*

Among flying men the saying goes, "There is no substitute for experience." That's just as true in the manufacture of outboard motors as it is in flying.

Without experience one couldn't develop fine motor design—or be sure of materials best suited to outboard needs—or even achieve a *modern* outboard motor plant.

As manufacturers who have contributed to the industry a major share of accepted outboard improvements (for more than 20 years) we are *experienced* in this field. You may be sure, when you buy a Sea-Horse, that you are coming as close to perfection as experience has brought the outboard motor to date.

JOHNSON MOTORS, Waukegan, Illinois

All our present effort is being put into war work—24 hours a day. We think about peace-time outboard motors only in the "25th" hour.

JOHNSON SEA-HORSES FOR DEPENDABILITY

— Can You —
JOURNEY INTO ANOTHER WORLD
yet remain in this one?

ALL of the intelligence of the universe is not centered on this small globe—the earth. Do you know that there are invisible forces and powers beyond this world that can—and do—influence you tremendously? If you could not see or hear, your present world would shrink greatly. Do you also know that you can do the opposite—extend your consciousness so that you can become a citizen of the universe? Stop being earth-bound! Let the Rosicrucian teachings unfold to you how your mind can annihilate space and cause you to experience a oneness with the Infinite and all of its worlds. Experience Cosmic Harmony!

Write for the fascinating FREE *book. "The Mastery of Life." Address: Scribe* Y.K.B.

TRUTHS AGELESS AS TIME
The Rosicrucians
SAN JOSE (AMORC) CALIFORNIA

BUY UNITED STATES BONDS & STAMPS

MacArthur—Master Of Air

[*Continued from page* 44]

down to where they were able to concentrate on three major campaigns—of which Australia was one. "It won't be long now," said the Australian fighting men in New Guinea. And then came a great Japanese task force with battleships, naval air carriers, cruisers and destroyers conveying troop transports, moving down the Louisiades to turn the corner and head for Port Moresby. The battle of the Coral Sea followed, the first naval engagement fought almost entirely by aircraft. The American Navy struck first. The Japanese aircraft carriers, Ryukaku and Shokaku, were sunk, followed later by the Akagi, Kaga, Soryu and Kiryu. Lockheed Hudsons of MacArthur's land based air forces contributed heavily to the toll of sunken Jap ships.

MacArthur's air forces, despite being far outnumbered, were beginning to make themselves felt, not only on land but on the sea. The total of Australian and American air force victories in and about the New Guinea area for a period of 127 days gives a score of 130 Jap bombers and flying boats; and ninety fighters destroyed, with some 200 damaged; one aircraft carrier destroyed, one probably destroyed, one seaplane carrier badly damaged; eight heavy and light cruisers sunk or damaged; sixty destroyers, fourteen gunboats and fleet auxiliaries, eleven freighters and twenty-one transports and supply ships sunk. A good share of credit for this toll goes to General Douglas MacArthur's direction of his airpower. Throughout this period the Japanese definitely had the edge in numbers of fighter craft as well as bombers.

Against the credit side of the score, however, is the criticism of General MacArthur for failure to place land defenses at the important Buna-Gona positions in New Guinea. These positions were a direct threat to Port Moresby, giving access to the one good track through the Owen Stanley Mountains via Kokoda. A strong Australian garrison was to have been put ashore there but the Japanese beat them to it by about a week, landing some 6,000 troops.

The unopposed landing of the Japanese at Buna-Gona was to cause a heavy expenditure of Australian blood, sweat and tears before its effects were cancelled. General MacArthur quickly flung air forces against the invaders. American bombers dropped twenty-three tons of bombs on the Buna-Gona positions and the battle was on. The Japs gathered strength and advanced halfway into Papua, overcoming the Australian militia at Kokoda. The thrust through the Owen Stanley Mountains gathered impetus. The necessity of stemming the Japanese land invasion of New Guinea and their planned attack on Port Moresby was complicated by the opening of our Naval offensive at Guadalcanal. This required diversion of MacArthur's air forces, sent streaming over Rabaul, to co-operate with the

MacArthur—Master Of Air

Navy in day and night blasting of Japanese air fields and shipping, with only indirect aid to the land fighting in the Owen Stanley Mountains. The successful seizure and holding of Guadalcanal by our Navy forces, aided by MacArthur's land-based aircraft marked the first passing of the initiative from the Japanese to the Allied forces in the South Pacific. But undetered, the Japanese struck at Milne Bay. Meanwhile continuing their remorseless progress, on the other flank steadily driving back the outnumbered Australians in the Owen Stanley mountains, with the threat to Port Moresby growing greater from two sides.

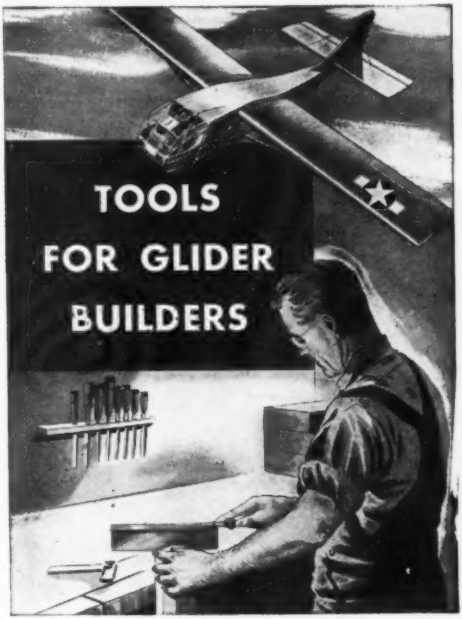
Just about the time that things looked their toughest General MacArthur put Major-General George Kenney in charge of the air service.

General MacArthur was anxious to fly in troops and supplies by air to stop the remorseless Jap advance. Almost everyone said that it couldn't be done. "Give me the crates and a few days to make arrangements and I'll fly the whole goddam United States Army in!" snapped Kenney.

Then came the "Wanigela operation" in which General MacArthur's air men, under command of Major-General Kenney, moved an entire American striking force, thousands of men and their equipment by air, from the mainland of Australia to Port Moresby and over the Owen Stanley range to Wanigela. This was an improvised air field on the north coast of Papua about 100 miles from Buna. At one time a perfectly loaded plane, complete down to the last piece of equipment for each man aboard, landed every three minutes! Eventually, Kenney moved one million tons of equipment over these treacherous mountains and jungles. Other bases were established.

Next, MacArthur scored the first 100 per cent victory of air power against sea power when his planes completely wiped out a Jap flotilla of more than 30 ships in the Battle of Bismarck Sea. The Japs outflanked, outnumbered and overwhelmed by MacArthur's use of air power, were driven from Buna and Gona. In due course, Salamaua and Lae fell. Australian troops were parachuted down *with their artillery*, to block the retreat of the foe up the Markham valley. Today the Japs are in process of being driven entirely from the shores of New Guinea. Beyond lies Rabaul, slowly being denuded of its flanking bastion outposts, slowly being encircled by encroaching air bases, remorselessly seized and made usable by MacArthur's combined use of air and ground forces.

There can be no question that General Douglas MacArthur has become "triphibious" as Prime Minister Churchill has expressed it; that he has solved the delicate equation of the proper use of air, sea and land forces in one of the toughest and most treacherous areas in the world.



One of the most significant developments of war has been the extensive and remarkably successful use of the glider. When Victory is won this useful craft undoubtedly will play a most important part in peacetime transportation.

Gliders are built rapidly and in volume by plants which specialize in this construction. Many of the tools used are made by Disston and include Disston hand saws, back saws, dovetail saws, compass saws, coping saws, circular saws, band saws, hack saws, files, mitre squares, bevels, gauges, levels, cabinet scrapers and others.

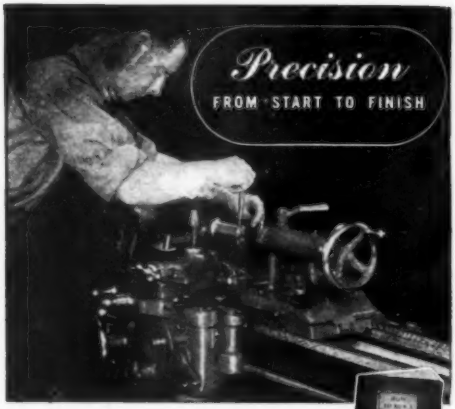
When you require tools for *essential* purposes, see your Hardware Dealer, and ask about tools by Disston. Here is the finest hand saw in the Disston line:

DISSTON D-42

Victory-lightweight Straight-back pattern. Made in 26-inch 7, 8, 10, and 11 points cross-cut, 5½ points rip.

MAKE TOOLS LAST with the help of the Disston Saw, Tool and File Manual — FREE from your Hardware Dealer, or write for your copy.

HENRY DISSTON & SONS, INC.
1208 Tacony, Philadelphia 35, Pa., U.S.A.



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South Bend 22, Ind. *Lathe Builders for 37 Years*

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AMAZING NEW BLADE SHARPENER

New sharpener for all makes of double-edge razor blades performs miracles! "Not necessary to change blades," writes one user. Another says, "Have used 1 bladeover 730 times." RAZOROLL really sharpens blades because it strops on leather. Gives keen, smooth shaving edges. No guesswork. Blade held at correct angle and proper pressure—automatically. Just turn crank to sharpen blade. No gears. Well made. Handsome, compact, sturdy. Weighs few ounces. Will last years. Makes ideal gift.

Only $1.00

SEND NO MONEY! Write today. Pay postman only $1 plus few cents postage. Use RAZOROLL for 5 days and if you're not delighted with smooth, velvet shaves you get, return RAZOROLL and we'll return your dollar. Hurry—order today.

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Yes Sir! With my new NEV-R-LOST key holder I never worry about losing my keys. If I drop it the bell rings—if I lose it the postman will return it promptly—THAT'S CONVENIENCE!

NEV-R-LOST KEY HOLDER

is made of genuine saddle stitched leather, with heavy celluloid address window — brass "bead" chain holds keys securely — nickle plate, rust proof bell (detachable for other uses) sounds a warning if dropped.

55c EACH 2 FOR $1.00 POSTPAID
Xmas Gift: 1 Doz. $5.00. Individually packed in Gift Boxes
FACTORY ASSOCIATES, INC., 500 FIFTH AVE., NEW YORK, N. Y.

80-Knot Concrete Ship

[*Continued from page* 48]

we are in a position to build a concrete transport that could carry, using the same horsepower, as many passengers as the Queen Mary across the Atlantic at 80 knots per hour. The crossing from New York to Liverpool could be made in 42 hours. It could be built with one-third the money, one-tenth the scarce material and labor that went into the Queen Mary. Because of its greater speed, it could make twice the trips and carry twice the number of passengers per week. After the war, these ships could be used as fast super liners with luxurious promenades, dance floors, salons, and swimming pools. They could more than hold their own against the air liner because of their greater comfort, luxury and safety and their ability to go regardless of weather.

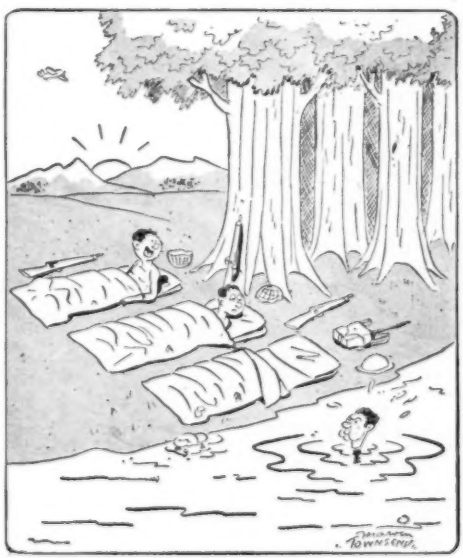
"We aim to concentrate at present," Mr. Hayes told me, "on building ships that can evade the enemy and deliver the largest amount of cargo the greatest distance in the shortest space of time."

Lektron can do it now.

In tribal wars, natives of New Britain in the South Pacific sew wounds with banana fiber thread and a needle of flying-fox bone.

Oil wells are drilled about five times as fast now as 10 years ago, the result of improved equipment and techniques.

Dental plates were first patented in the United States in 1840.



"The sergeant got up on the wrong side of the bed this morning!"

Debunking Test Pilot Myth

[*Continued from page 59*]

Ed Virgin, chief of North American's Experimental Flight Test Section, is consulted frequently by the design engineers. Often new proposals are laid before the test pilots' section as the very first step; here, Virgin, Chilton and the other test pilots may veto the idea on the basis of their flying experience without the idea ever getting into the preliminary drawing stage.

In the event there is any doubt that a crack test pilot must also be a first-rate engineer, here is an idea of the workout Chilton gives a prototype. First, he makes handling characteristic tests (to obtain the proper force and balance between all controls); this usually leads to many changes. In order, principally, to meet the cooling requirements set up by the ultimate purchaser, the ship is put through different engine operation tests.

Functional tests of all instruments are made, cockpit controls are tested for accessibility and ease of operation, a check is made of the landing gear and flap operation, brake system operation and all emergency controls.

In addition to prescribed structural dive tests, the proper flight technique for the particular airplane involved is established.

Spin tests are made and note is made of the maximum performance, which includes speeds at all altitudes, rate of climb, maximum altitude and service ceiling.

On a Mitchell bomber, Chilton checks off as many as 120 routine items. On the Starting and Ground Operation of the ship's two engines, there are 32 separate details to be observed. In order, the remaining 88 items on the list take up dozens of phases in Before Take-Off, Take-Off, Climbing, Cruising, Landing, After Landing, Stopping Engines. Which doesn't leave him much time to play parcheesi, but every experienced E.T.P. can remember most phases—however, they generally bring the check-off list along.

In the air, a test pilot's time is fully taken up with his job, despite the use of motion picture camera recorders which make photographic readings of all important instruments. In a single-seated Mustang, as many as half-a-dozen cameras are sometimes installed at one time. When some of the super-cargo-ships like the Douglas C-54 fly on test trips, usually about eight observers go up in her, stationed at various points in the fuselage, studying the test installations which thread their way through almost every part of the huge plane to record strains and stresses.

In the not-too-distant future, a little radio set named Joe may displace test pilots for some experimental work. If this seems rather far-fetched, consider that radio-controlled planes are in practice today, and take off, fly, dive and bank at "their master's voice."

Radio-controlled test planes will certainly create havoc in the glamour industry, as far as E.T.P.'s are concerned.

FILES FOR PLASTICS

PLASTICS . . . an immense new world of industry is advancing under the steady development of this multi-purpose material. Many types, with remarkable characteristics, are rolling out of the engineering laboratories . . . vying with aluminum, steel and other metals in the manufacture of thousands of products.

Plastics finishing and fabricating call for various shapes and cuts of files—for sprue and flash removal; for smoothing and reaming; for work in corners and notches; for hard and soft compositions.

Files for plastics must have a "dry" (not "oiled") finish; and to overcome clogging when used on soft or "shreddy" material, they need well-spaced teeth. To combat the abrasive action of certain thermoplastics, teeth must be hard and thin-topped to maintain sharp cutting edges as tips wear down.

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"FILE FILOSOPHY"

Tells about many regular and special purpose files; how to use and take care of files; how to select The right file for the job. Useful to production and purchasing heads, invaluable to mechanics, toolmakers, diemakers, saw filers, repairmen, mechanical "trainees."

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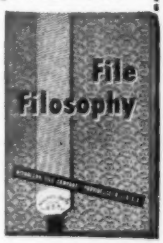

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N. W. SCHOOL OF TAXIDERMY, Dept. 2869, Omaha, Neb.

Continent Of Tomorrow

[*Continued from page* 62]

operations have been undertaken to date. As the eighth largest producer of manganese, however, Chile is again scoring in the War effort.

Gold is a typical example of lack of enterprise that should tempt the American going south to try his luck. There never was any wild enthusiasm over gold mining in Chile.

The same lack of enthusiasm followed the discovery of gold-bearing sands near the Straits of Magellan.

They call the Chileans "The Yanquis of South America." You will probably find this true in a broad sense only. They are civilized as much as we are on all fronts, and in some ways their culture is in advance of ours; but when it comes to the tougher brands of pioneering, developing and opening up virgin country, they usually let George, the foreigner do it.

It is probable that you will disembark at Valparaiso, the largest town on the West Coast. Men from every State in the Union, from every country on the globe, pass through Valparaiso sometime on their trek in search of El Dorado. You will discover within the first hour that Chile is an inexpensive country, with the peso about 3 cents. You begin to realize this when you take the Pullman train from Santiago, the Capital, and ride the 115 miles in less than three hours at less than a cent a mile.

Santiago is a beautiful city lying in a bowl of mountains. You can stop at the Hotel Crillon—as good as any inn in the world—for $3 a day. Edward, when Prince of Wales, called the Hippico "the finest race track in the world." A gourmet dinner with wine at Henri's, the famous seafood restaurant, costs a dollar. At native "La Trinchera," a course dinner with filet steak will set you back 32 cents. Or you can go Yanqui and have buckwheat cakes at Child's, a branch of the New York restaurant chain.

One of Chile's pillars of wealth is Chilean wines raised in this section. Wine exports in 1920 were only 175,000 gallons. The figure had risen to 1,773,000 gallons, when the war stopped all exports.

A strip of Central Chile, 500 miles long by 150 wide, comprises 95,000,000 acres of arable land, with rich soil from three to thirty feet in depth, only a small portion of it under cultivation. It could raise ten times the present crop of stone fruits, grapes as big as eggs and luscious honey dew melons for the American table trade.

Nearly one-third of Chile lies beyond, in the far south. 75,000 square miles covered with 39,000,000 square feet of the most commercially valuable timber on the whole continent, that has scarcely been nicked by the lumberman's ax. And yet, they are suffering for the want of wood in many remote parts of their own country.

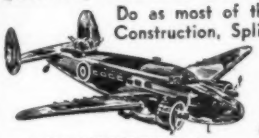
Continuing into near Antarctic regions, you find yourself in the sheep country, where Andrew

[*Continued on page* 154]

Quickest, Easiest, Most Economical Way of Getting Pre-Flight Training!

Do as most of the men in the Air Forces did—learn Flight Theory, Design, Construction, Split-Second Recognition of important War Planes, by building

CLEVELAND MODELS



Lockheed "HUDSON" Bomber
Called "Old Boomerang" by British, for it usually comes back from all raids. Big 49¾" span. C-D Master Kit SF-93 ---------- $7.50

No. Amer. "MUSTANG" (P-51)
Tough, vicious fighter. Span 27 3/16". C-D Master Kit SF-91 ---------- $3.00

Vo-Sik. "CORSAIR"
Navy fighter. Span 30 3/16". C-D Master Kit SF-79 ---------- $3.50

Douglas SBD "DAUNTLESS"
World's nardest hitting dive bomber. Span 30¾". C-D Master Kit SF-89 ---------- $3.50

Republic P-47 "THUNDERBOLT"
"The Flying Battleship." Span 36¾". C-D Master Kit SF-81 ---------- $4.00

Bell "AIRACOBRA"
Deadly "cannon-plane". Span 25½". C-D Master Kit SF-76 ---------- $3.00

36" Industrial Training Models

Build these big 3-ft. span models. Each a realistic beauty.

Kit T74: Messerschmitt ME-109
Kit T76: Bell "Airacobra"
Kit T77: Curtiss P-40 "Warhawk" (shown)
Kit T78: Hawker "Hurricane"
Kit T85: Lockheed P-38 "Lightning"
Kit T91: P-51 "Mustang"

Each complete Kit, only $1.50

Lockheed P-38 "LIGHTNING"
Fastest thing on wings. Span 38¾". C-D Master Kit SF-85 ---- $4.00

"WILDCAT"
"Ace of the Pacific". Span 26¼". C-D Master Kit SF-83 ---------- $3.00

Huge, Redesigned 7-Foot Super Condor Glider Soars for Hours

Stronger, longer flights, more graceful lines, construction simplified. Easier to build than ever. Kit E-5019, only------ $1.00

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Continent Of Tomorrow

[*Continued from page* 152]

Peck made his fortune. 48,000,000 acres here are said to produce some of the best wool in the market. The sheepherders are all foreigners, mostly of British origin. They started the industry only a little more than fifty years ago, with an experimental flock. They have their own metropolis, Punta Arenas.

Peace will bring the biggest change this world has ever known. Almost overnight, millions of men will find themselves on the loose. America will do everything in its power to find jobs for them. But it will take a long, long time. A million young war-created engineers will be seeking machine shops, mines, prospecting the open spaces. Another million young newly made aviators and mechanical assistants will be ready to take fleets of airships off the ground. South America stands waiting for these fellows with wide-open arms. Chile is another rich segment of the last frontier.

Armchair Strategist

[*Continued from page* 69]

ground troops attack underneath, protected by this umbrella of fire.

But the fighter plane is a short range weapon compared to the bomber. It needs bases nearer to the enemy walls. Most of those bases are held by the enemy in the form of the stationary aircraft carriers provided by the outer screen of islands fringing the continental land mass of Europe and Asia. While there is always danger of over-simplification, the fact remains that our battles for islands in the various European and Asiatic waters are simply fights for fighter plane bases.

It might clear up and simplify the picture to realize that most of the military activities now going on in Europe and Asia, are integral activities, parts of that preparatory work, the seizing of island bases, the strengthening of lines of circumvallation, the softening up of the enemy—all of them necessary steps to the final assaults, from many points, on the fortress continent of Eurasia.

With this picture clearly in mind, that of the siege of an embattled continent fortress, now take your pins and place them on your map (by the way, back it up with a piece of carton cardboard so your pins will stay put). Study the terrain of the map, hills, valleys, communications, distances, and *figure out what you would do if you were the enemy commander.* Then take your counter moves against the most logical of enemy actions and provide for your own *security.* By these means you should succeed in becoming an amazingly adept smoking-room strategical seer. You may even be entitled to emblazon your armorial bearings with a microphone, *rampant,* and an armchair, *couchant,* adopting as motto the secret pass word of the craft, the magic words—"I told you so!"

Your Invention Clinic

[Continued from page 12]

Camp Roberts, Calif., has designed a lock washer with bendable flaps for use on bolts and nuts.

ANSWER: *We feel sure that if you will have a patent search made you will discover that many lock washers with similar features have been patented. In fact they have been used on radio sets and on the simplest of mechanical devices. The one major objection to their use is that the bolt itself must be milled, slotted or faced to accommodate the lock washer. Some of the more modern lock washers dispense with the need for this operation; they hold quite as securely. We feel sure you can do nothing with your suggestion.*

Screw Driver

Cpl. Robert S. Myers, Pyote A. A. Base, Texas, has recommended an improved type of screw driver.

ANSWER: *We presume that you have designed a combination screw driver, i. e., one which will fit both types of handles interchangeably. This finding is not made clear in your explanation. However, if that is your intention we believe that you have an interesting tool which might meet with a favorable market. In fact, we would suggest that you furnish a third handle to produce an off-set driver unit.*

In accordance with our policy the details of your design have been withheld here. We would recommend that you have a search made to determine patent possibilities.

Refillable Ant Control

Harry A. Astrowski, San Francisco, Calif., submits a model and design of a refillable ant control.

ANSWER: *Every ant control box could be made so that it could be refilled by the purchaser. The reason that these controls are made non-refillable is to prevent access to the highly poisonous contents. In your design you defeat the very advantage which the non-refillable types now possess; namely, they cannot be tampered with easily. Consequently, a curious youngster would find it difficult to get at the poisonous contents of present styles, but could do so with ease in your construction.*

Again, if the present manufacturers desired they could supply the poisonous paste in tube form so that it could be injected into the interior of present traps. This would make the unit more safe than your design, but would limit resale.

Although we believe that you could probably do something with the ant control unit you have built, we doubt that a manufacturer would be impressed with its refillable features. We advise against further action.

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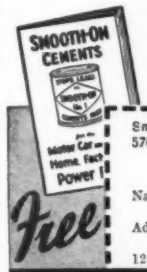

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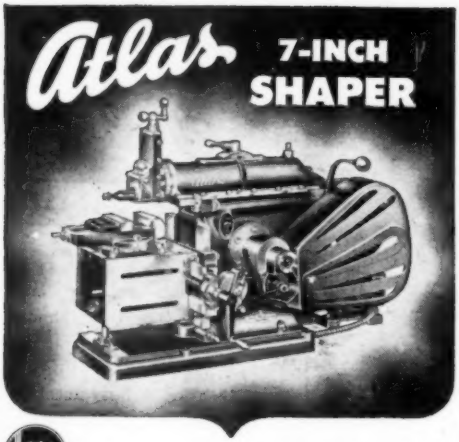

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Flying Guns

[*Continued from page 66*]

obtained, those for the recoil are secret. But a calculation of the impulse will yield some figures which, although pretty valueless in themselves, can serve for comparison with each other.

The figure found for the impulse of the 75 substantiates the suspicion that it may cause recoil trouble. The weight of the gun itself can hardly be the reason. But the weight of the ammunition is another story.

The complete cartridge of the 37 weighs 1.4 pounds, the shell of the 75 alone weighs a little over 13 pounds, as much as ten complete rounds for the 37. The whole cartridge of the 75 equals 17 complete rounds for the 37, weight for weight the 37 produces 17 times as many shots, 17 times as many chances to hit. The high weight of the ammunition argues strongly in disfavor of a flying 75 as far as aerial combat is concerned.

But something like a flying 75 would be desirable for ground attack planes, for tank fighters. The 37 can do well against truck convoys, staff cars (the enemy equivalent of our jeeps), and even against light tanks. But it is powerless against medium and heavy tanks, except for the rare chance of a hit which breaks a tank tread. Here a heavier flying gun would be desirable and in this case the weight of the ammunition is not so important. It is much easier to hit even a moving tank than it is to hit another plane.

Because of its recoil it would have to be a fixed gun, unless there is a way of avoiding the recoil. Such a way exists, a recoilless gun was invented during World War I and is known in military literature as the Davis non-recoil gun. (See MECHANIX ILLUSTRATED, August, 1942.)

One may consider another possibility here: that the big gun plane carries a different type of ammunition for defense against air attack. If it fires a shell that, after leaving the muzzle, breaks up into eight or nine smaller shells with time and contact fuses, the big gun may be useful against enemy fighter planes, too. One may also suggest a revival of an old and now all but forgotten projectile for this purpose: chain-shot. The old chain-shot consisted of two iron hemispheres connected by a length of chain nestling inside. When fired the two hemispheres invariably separated as far as the chain would let them, often rotating around each other in flight, somewhat in the manner of the South American bola.

All this shows that the big gun airplane is possible, but it seems likely that it will be useful only as a tank fighter and that it might be vulnerable to enemy air attack, unless heavily escorted by ordinary fighters.

Whether such a flying tank buster has enough tactical advantages to be worth the expense and trouble of development is another question.

Cactus fiber is now used in padding upholstery of some motor cars.

American daVinci

[*Continued from page* 53]

He finds lengthy specialization too confining for an active intelligence.

He has, with some justice, been called the Leonardo da Vinci of the laboratory, a man who is as catholic in interests as he is Catholic in belief. Not since the monastic studies of medieval scholastics has there been such an ardent champion of the over-all vision in the sciences, of exploration in every direction. The whole world is his scientific oyster.

At the age of 19, Dr. Sperti enrolled in the cooperative engineering courses at the University of Cincinnati, supporting himself by working after hours for the Cincinnati Gas and Electric Company Meter Laboratories. Climbing over coal piles and groping through cellars in the slums of Cincinnati to test meters, George became interested in the electrical apparatus he handled. In those days there were no means for measuring the huge power loads of large industrial plants, and his superiors assured him that no meter could be built to do the job. George, then a senior in college, sat down at his mother's kitchen table and, working on a breadboard with a couple of 10-cent hacksaws, invented a K-va polyphase power-factor meter. His contracts covering American and foreign rights on his meter patents aggregate nearly $50,000. The principles of the Sperti meter are employed today in many large industrial plants throughout the world.

By the time he graduated, George had outgrown the lone-wolf concept of scientific work and was toying with the idea of co-ordinated research. In line with that idea, and stimulated by seeing a loved one suffer from the ravages of cancer, he began to branch out from electrical engineering, trying to apply his knowledge of light to cancer research. As a by-product of his initial efforts, he hit upon the principle of selective irradiation, whereby all but the vitamin-D-producing rays are filtered out of the ultraviolet spectrum. He was then an assistant professor at Cincinnati.

At about that time (1926) the University of Cincinnati set up its Basic Science Research Laboratory, with Dr. Sperti as its founder and direc-

[*Continued on page* 158]

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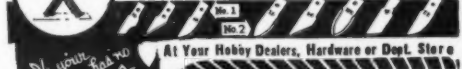

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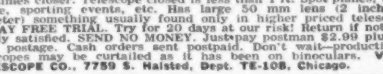

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[*Continued from page* 157]

tor. Here the young scientist had a free hand to organize investigations of fundamental problems by employing all the basic sciences. Here, too, his conviction grew that scientists, when they put their heads together over some vital problem, needn't be entirely at the mercy of wealthy benefactors and institutional grants. They should, he felt, pay their own way, at least in part, by turning incidental or partial discoveries from their co-ordinated research to practical use. The selective irradiation discovery only bolstered this conviction. An off-shot of Dr. Sperti's cancer research, it was bought up by General Foods for $300,000, which sum was donated to the University by Dr. Sperti.

In 1935, the Most Rev. John T. McNicholas, Archbishop of Cincinnati, came to Dr. Sperti with a proposition. How would he like to help found and preside over a new graduate school of research, to be called the Institutum Divi Thomae (Institute of Saint Thomas, after its patron saint, Thomas Aquinas)? The school would be located at the Athenaeum, Catholic seat of learning in Cincinnati. Dr. Sperti decided he would like it fine. Co-ordinated research got the chance of a lifetime in this new set-up: a handpicked staff of expert chemists, plant physiologists, biochemists, pharmacologists, zoologists; an up-to-date laboratory at headquarters, and another at Palm Beach, established in a former gambling casino, given to Dr. Sperti for the study of marine life by Col E. R. Bradley; branches in 13 hospitals, medical and graduate schools to carry on clinical research.

Dr. Sperti chose cancer as his basic problem. He was right. The Institutum today is drawing royalties on dozens of patents which were registered as the cancer work progressed. Fluorescent lighting devices, food preservation methods, meat tenderizing processes, vitamin preparations—all are paying for the center's upkeep. At least $50,000 a year comes from the Sperti sunlamp alone, which, through selective irradiation, produces vitamin D and tans the skin without risk of burning. And the central project, cancer research, flourished. Institutum workers have already succeeded in immunizing animals against certain types of cancer, and in curing them of some forms of the disease. But the staff's most spectacular product to date has been biodyne ointment.

Dr. Sperti presented his staff with a simple idea. He said, in effect: "When a living tissue is injured, the surrounding cells spring into feverish activity. They go haywire; all their life processes are speeded up and they reproduce like mad until the wound is healed. There must be some factor that checks or stimulates cell metabolism. If that factor—hormone, chemical, secretion, call it what you will—can be isolated and studied, we might very well learn something about cell growth and reproduction, and thus about cancer too. The first step is easy: yeast cells, tissues of chick embryos and lizards can be injured by overdoses of ultraviolet rays. Then we can try washing the treated tissues in a sterile solution and filtering the cells out. What remains in the fluid—maybe—will be the growth factor we're looking for. If it's there, it should make the cells of normal tissues breathe and grow faster, consume more sugar for energy, reproduce more rapidly. Let's give it a try."

The solutions were made, uninjured tissues were placed in them, and the staff sat down to wait. One afternoon in 1937 Dr. Sperti visited the laboratory and examined the various instruments that indicated metabolic rates. With extreme care he sealed the instrument case, wrote a "Do Not Disturb" sign on it, walked out and locked the door behind him. He called the staff together, and they assembled in an expectant hush. Most of them realized that, if the little dials and meters in that laboratory registered positive results, their discovery might have as far-reaching repercussions as those of Ehrlich and Pasteur. "I think," Dr. Sperti said, with awe in his voice, "I think we've got something there. We'd better find out what it is." The newly discovered substances were named biodynes, from the Greek *bios* (life) and *dyne* (force).

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American daVinci

Biodynes were a triumph for the co-ordinated research idea, for they were stumbled upon in the course of investigating cancer. They proved to be an even bigger discovery than anyone had dared to think. One day a nun was working at the Institutum when an ether-extracting apparatus exploded in her face, and she suffered third-degree burns. In the emergency, her associates took a big chance and rubbed some biodyne ointment over her wounds. Pain ceased immediately, and in a few days little islands of new skin began to appear on the scorched areas. In less than two weeks the burns had healed, leaving no telltale scar tissue. Subsequently, large quantities of the salve, which consists of biodynes mixed with a greasy base, were donated to the victims of the Boston nightclub fire, and more was sent to Dr. Thomas F. P. Walsh of Mercy Hospital in Chicago, who used it on over 100 cases of severe burns with miraculous results.

It has also been found that many bactericides, including sulfa drugs, have a toxic effect on the skin, inhibiting the breathing of its cells, delaying proliferation, and thus prolonging the healing period. Biodynes have been successfully used with them to bring the respiratory rate up to normal. Thus the discovery of biodynes may pave the way for a whole new therapeutic approach to infections.

Dr. Sperti is a scientist's scientist. He argues vigorously that "to hog-tie a brilliant mind to detailed investigation is a criminal waste of time," and the Institutum is organized so that every man's talents are called into full play. In short, his life is so arranged that his mind is free to concentrate on the business at hand—the discovery of new knowledge about the workings of the human organism. Dr. Sperti is not repelled by the suggestion that scientists are prima donnas. "Why not?" he says. "Who has a better right to be? It's about time somebody provided the settings and the stage managers and let them perform. It's a good investment."

On a drizzly day late in 1942, two doctors from the Institutum boarded a plane at the Cincinnati airport, carrying with them supplies of biodyne ointment. They were on their way to a desolate spot in the Canadian wilderness, 2,000 miles away, where eight members of the Royal Canadian Air Force, horribly burned in action, were lying helpless. For two weeks there was no word from the doctors. Then, suddenly, a long-distance call came through for Dr. Sperti. "Hello, Doc," a far-away voice said. "Sure, we got through O.K. They're going to be all right." Dr. George Speri Sperti was not sorry then that he had pampered his prima donnas.

This is the first of two articles on Dr. Sperti. The next will appear in January issue of MECHANIX ILLUSTRATED.

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Knocking Down My Triple

[*Continued from page 40*]

our formations were over the Channel. We could look down at it, and see the blue water flecked with whitecaps, and ships that looked like toys away down there.

We had a little different sort of a job to do that day. The Flying Fortresses, with their big bellies full of explosives, had gone to bomb Kassel. Usually, when they were on missions like that, we'd meet them over France, and give them supporting action on the way home. Now, though, we were going right up to Germany to see what we could do to the Jerry fighters.

I thought of those things as the formation sped along, and chuckled over the thought that the Jerries certainly wouldn't expect us so far inland, and certainly would be most unhappy about the whole thing.

Then, suddenly, there it was!

The Fortresses, keeping a tight formation to prevent the Jerries from sweeping in between them, were ploughing steadily toward home, guns spitting from turret and ball, waist, nose and tail. Around them swirled what seemed to be hundreds of enemy fighters, diving and firing, and climbing to dive again. It was a terrific sight and my pulses began to beat faster. This was going to be the real thing.

The Jerries had no reason to expect our appearance and their attention was concentrated on the Forts. Just as we came up one of the Flying Fortresses was badly hit. The props of two of her engines feathered and she began to lag behind, unable to keep up with the formation.

The bombers were to the left of my squadron, and I saw five Jerries on the tail of the straggling Fort. We peeled off and swung in behind them. They broke formation, and raced away as fast as they could go. No use chasing them. There were plenty of others to tangle with. I swung under the bombers and came up on the other side, flying parallel with them.

What happened immediately afterward seems a little funny looking back on it, but the implications of the moment were too grim to bring a smile. About a thousand yards ahead I saw several Focke-Wulfs queuing up to attack a bomber. That's just what they were doing, lining up one behind the other like people waiting for a bus in London.

My wing man, Koontz, saw them at the same time. He mentioned it over the interplane transmitter, and added: "Peel down, and get 'em, Major—I'll close the back door for you."

It looked like a good idea, so I went downstairs in a hurry. The pilot of the plane on the tail end of the queue was intent on the attack and did not look back. Not looking back every once in awhile is a fatal mistake in a jamboree like this. The Jerry was my bacon and I fell in behind him, chuckling a little. It was just too easy. I could take my time. I buzzed along until I had him in

Knocking Down My Triple

my sights and was close enough not to miss. Then I pressed the button, giving him a single burst. That was enough.

I don't think he ever knew what hit him. That plane was a dead duck, flying with a dead man at the controls. The ship wabbled, smoked, burst into flame. It began to spiral, and then went down, spinning like a top. I took a quick glance back, but had no time to watch it crack up.

I saw a couple more FW's queuing up about a mile ahead. They weren't looking around, either, which was fatal for them. With Glenn Koontz on my wing I rode up until I was directly behind one. He didn't know I was there until I poured a load of .50 calibre bullets into him. Glenn took care of the other one, and for once a wing man had something to cheer about.

The battle wasn't static. It moved steadily out of Germany, over France, westward, always westward. The Forts were driving steadily for home, spitting explosive and incendiary and tracer bullets. The Germans attacked, diving, swinging around or upward, to come and strike again, while we hacked at them, and they fought back at us.

The party wasn't over yet. We went for some more Jerries, my wing man and I. We swung over to the left of the bombers again. Some more enemy planes were queuing up on another Fortress.

Our trick had worked twice and, since nothing is more successful than success, I figured we ought to try it again. Koontz and I hooked onto the end of the line just as the Jerries were making a turn to come head on into another Fortress. I beaded on the last one, an ME .109, and let go. The tracers poured into him. He heeled over and went down spinning.

"Three!" yelled Koontz. "You sure hit the jackpot today!"

Then the Jerries decided to break off combat. They went high-tailing for home and we didn't chase them, because we had used up just about all the gas we could spare. I felt very warm and comfortable inside. It had been a great scrap. I didn't know how many we had bagged or how many we had lost, but I was sure the score was distinctly in our favor. The fact that I had been flying a new plane and not my "Spokane Chief" never occured to me until that moment.

The ride back home was mighty nice. I relaxed and enjoyed the flight, and thought about a lot of things. I thought about Jean, of course, and wished she could have seen the fight. But I knew she wouldn't have wanted to. So long as I was in it she would have been too nervous to enjoy it.

Looking down I saw the green fields of England.

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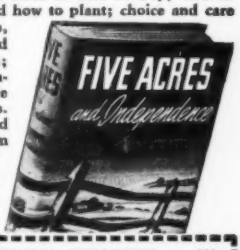

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A message for you . . . from 1953

(Today, John Jones is just an average American, wrestling with all the doubts and worries and problems that beset every one of us right now. But let's skip ahead 10 years. Let's look at John Jones then—*and listen to him . . .)*

"SOMETIMES I feel so good it almost scares me.

"This house—I wouldn't swap a shingle off its roof for any other house on earth. This little valley, with the pond down in the hollow at the back, is the spot I like best in all the world.

"And they're mine. I own 'em. Nobody can take 'em away from me.

"I've got a little money coming in, regularly. Not much—but enough. And I tell you, when you can go to bed every night with nothing on your mind except the fun you're going to have tomorrow—that's as near Heaven as a man gets on this earth!

"It wasn't always so.

"Back in '43—that was our second year of war, when we were really getting into it—I needed cash. Taxes were tough, and then Ellen got sick. Like most everybody else, I was buying War Bonds through the Payroll Plan—and I figured on cashing some of them in. But sick as she was, it was Ellen who talked me out of it.

"'Don't do it, John!' she said. '*Please* don't! For the first time in our lives, we're really saving money. It's *wonderful* to know that every single payday we have *more* money put aside! John, if we can only keep up this saving, think what it can mean! Maybe someday you won't have to work. Maybe we can own a home. And oh, how good it would feel to know that we need never worry about money when we're old!'

"Well, even after she got better, I stayed away from the weekly poker game—quit dropping a little cash at the hot spots now and then—gave up some of the things a man feels he has a right to. We made clothes do—cut out fancy foods. We didn't have as much fun for a while but we paid our taxes and the doctor and—we didn't touch the War Bonds.

"We didn't touch the War Bonds then, or any other time. And I know this: The world wouldn't be such a swell place today if we had!"

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